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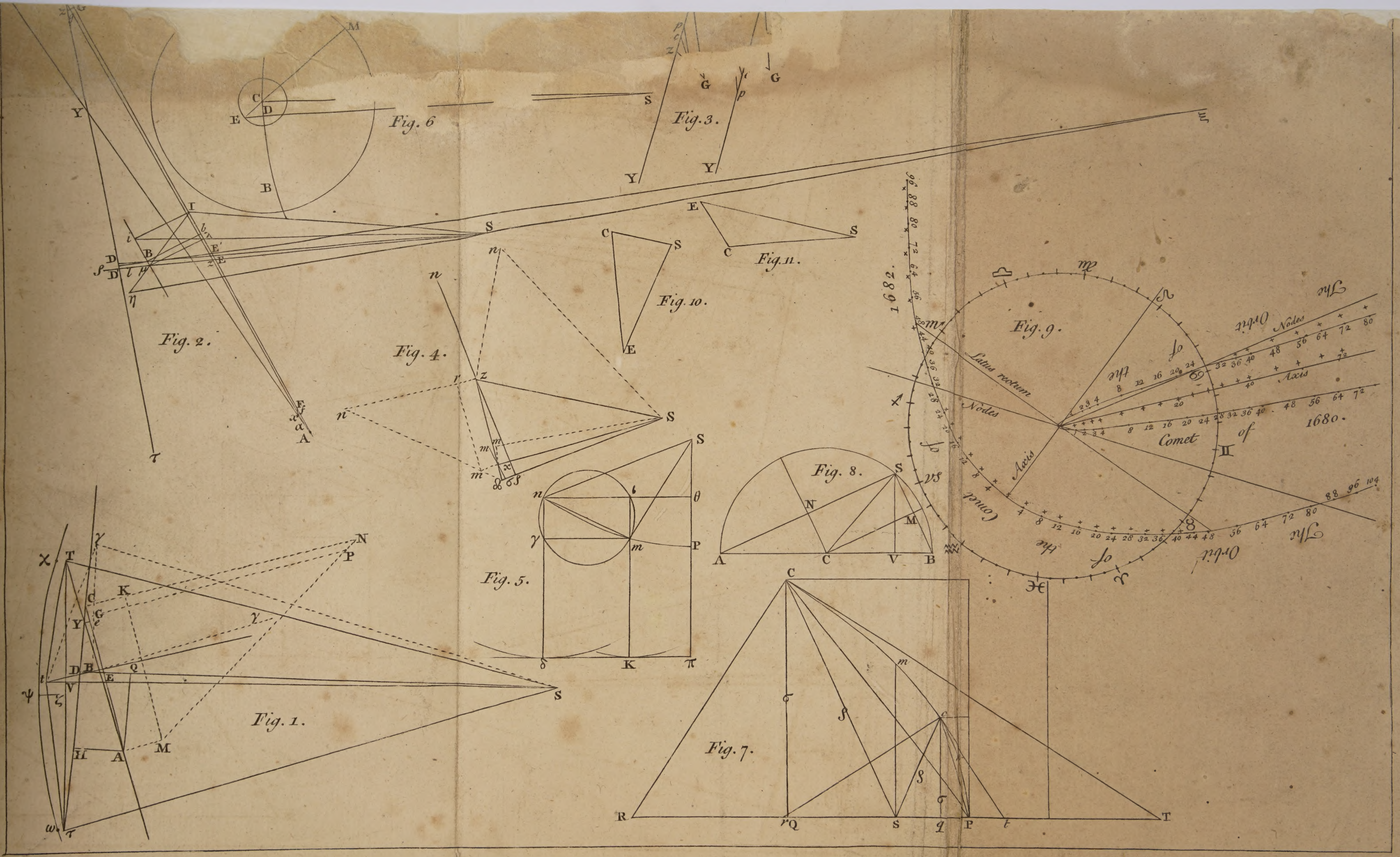

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

J. Mynde sc.

AN

ACCOUNT

OF THE

Diſcoveries concerning Comets,

WITH

The Way to find their Orbits,

And ſome Improvements

In conſtructing and calculating their Places.

For which Reaſon are here added

New TABLES, fitted to thoſe Purpoſes;

Particularly with regard to

That COMET *which is ſoon expected to return.*

By THOMAS BARKER, Gent.

JOB XXVI. 14. *Lo, theſe are a part of his ways: but how little a portion is heard of him!*

SEN. Quæſt. Nat. Lib. VII. 31. *Multa ſeculis tunc futuris, cum memoria noſtri exoleverit, reſervantur. Puſilla res mundus eſt, niſi in illo quod quærat omnis mundus habeat.*

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THE CONTENTS.

Gradual diſcovery of the motion of comets.

Page 1. *Ariſtotle occaſioned comets to be neglected. Seneca's opinion truer, but little regarded.* 2. *Appian firſt obſerved comets. Petit's hypotheſis about them, and Hooke's of gravity.* 3. *Hevelius's thoughts of a parabola.* 4. *How far true. Sir Iſaac Newton, applying gravity to comets, firſt proved their parabolick motion. Comets do not go to other ſyſtems.* 5. *In ſtrictneſs, move in extremely long ellipſes. Periods of ſome of them, and probable cauſes of their periods being unequal.*

The way to find a comet's trajectory.

Page 6. *Sir Iſaac Newton and Dr. Gregory demonſtrated it.* 7. *Muſt be done groſsly at firſt.* 8. *How to chuſe the obſervations; to correct the orbit.* 9. *To be perfected by calculation. Of the menſtrual parallax, ſee table* IV. *and* V. *Liſt of the triangles uſed in calculation.* 11. *Reaſons for ſome alterations.* 12. *Sir Iſaac Newton's laſt correction omitted. Orbits of the ſeveral comets how collected, ſee table* I. 13. *Which are beſt done; that of* 1744 *proved true.* 14. *Whence the orbits are collected, and caution about inſerting the node.*

The table of a parabola, and uſes of it.

Page 15. *Dr. Halley's table too ſhort. Mine on a different plan, ſee table* II. *Demonſtration of the truth of it.* 16. *Examples of calculation.* 17. *Accuracy of the table, ſee table* III. 18. *Diurnal motion of comets, and way to calculate their places.* 19. *To change ſines and tangents.* 20. *Examples of calculating a comet's place.* 21. *Some other uſes of the parabolick table, examples are given in table* VIII. IX. X. 22. *Method of drawing a comet's orbit.* 23. *How to conſtruct it's places by it: other uſes of ſuch an orbit, and gueſſing at a comet's period by it: examples given of the comet of* 1682 *in table* XI. XII. 24. *Where it may be expected to appear, and how ſoon or late it's next perihelion may be ſuppoſed to be.*

General and moral reflections on the whole.

Page 24. *The nature and uſes of comets little known. The works of creation innumerable.* 25. *Shew forth the greatneſs of God. The conſideration of the heavenly bodies greatly enlarges our view. Comets of different uſes from planets. The greatneſs,* 26. *multitude, and wiſe diſpoſal of the works of God, ſhew the fitneſs of ſubmitting to him, impoſſibility of eſcaping him, and folly of not yielding to what he has revealed.*

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THE

PREFACE.

THAT bright comet, which was ſeen in 1744, *having raiſed in me as well as others a greater curioſity about them; I had once thoughts of undertaking a kind of hiſtory of comets, which, beſide what is given here, ſhould contain an improvement of Hevelius's and Lubienietz's accounts of the ancient ones, and a continuation of them to the preſent time. The alterations I deſigned to make were theſe: Firſt, To leave out the aſtrological obſervations, which the old authors, looking on comets chiefly as prodigies, are full of, and Lubienietz's book is almoſt all ſo; to quote nothing but what relates to the comet itſelf; and in later times, when there are many accounts of the ſame comet, to inſert the principal, and perhaps paſs over ſome of them which contained nothing new. Secondly, Hevelius and Lubienietz take many comets only ſecond hand, from Rockenbach and other modern writers, but I would as much as poſſible have quoted the original authors. Thirdly, Different perſons not uſing the ſame chronology, have often made ſeveral comets of one. Thus the four Seneca reckons up* Nat. Quæſt. VII. 17. *after the death of Julius Cæſar, under Auguſtus, Claudius, and Nero, are in Hevelius increaſed to thirteen; and the two laſt of them, which he calls the two comets ſeen in our time* VII. 23. *Lubienietz has made eight of. Fourthly, Lubienietz ſwells his hiſtory with balls of fire, northern lights, and perhaps other meteors: all theſe, as alſo multiplying of real comets, I deſigned to have avoided where I could. In purſuit of this deſign, I made a liſt of the comets which had been ſeen, with references to the authors who mentioned them, ſo far as I had then found, leaving room to add more, as I met with them; and began to draw up the account of a few of the firſt with the authorities, but found ſo little ſatisfaction from the very imperfect accounts, that perceiving the benefit would not anſwer the trouble, I laid the deſign aſide. Yet having now had by me for ſeveral years a table of the parabola, which ſhews the ſpace, and diſtance from the focus at all angles, and will, I think, by it's length, better anſwer the end of calculating a comet's place, than Dr. Halley's table can, I choſe no longer to conceal it: but that it might not ſeem too imperfect, by being publiſhed alone, I have added a ſhort account of the diſcoveries about comets, a catalogue of their orbits, the way I calculated the parabolick* *table, and method of uſing it, alſo how to conſtruct a comet's motion ſpeedily. In particular I have given ſome account of the uſe of Sir Iſaac Newton's famous problem for finding a comet's orbit from three obſervations, which till lately few perſons have ſtudy'd; yet ſeems to me a much better method, than that Caille has given in art.* 518—560 *of his aſtronomy, which he ſhews in art.* 520, *does not anſwer in all caſes, and requiring ſo much correction by gueſs, muſt I think be very troubleſome. In ſtudying this problem of Sir Iſaac's I almoſt got beyond my depth; yet by comparing his explication with Dr. Gregory's, and the aſſiſtance at firſt of Mr. G. Whiſton, with a repeated examination ſince, I hope I have gained a tolerable knowledge of it, and have endeavoured to render the proceſs as exact, eaſy, and plain as I can. But though mathematicks is a ſcience capable of abſolute demonſtration, yet in ſo complex a problem, eſpecially where ſeveral parts are only approximations, the mind of man is frail, and may overlook ſome ſmall circumſtance, which may render his reaſoning a little defective: ſuch at leaſt I own my underſtanding to be, and the more as living in a retired place, I am forced to truſt to my own ſtrength. If therefore on tryal I be caught tripping, far from taking any friendly admonition amiſs, I ſhall think myſelf greatly obliged to any one more ſkilful than myſelf, who will by letter or otherwiſe inform me, either where I have miſtaken, might have made the method ſhorter or eaſier, or have omitted any further uſe or improvement; I ſhall not fail on any proper occaſion to acknowledge the favour, and, if opportunity offers, to make a due uſe of it, being deſirous to compleat the affair as far as I can.*

Lyndon, Rutland.
Sept. 15, 1756.

P. S. *Mr. Facio, as Dr. Halley mentions, thought of a uſe which may now and then be made of comets; by obſerving the parallax of one when very near the earth, to find the ſun's parallax, and conſequently it's diſtance, now known only to a fourth part. The expected comet will not come much nearer the earth than Mars does, if it's perihelion ſhould be in January or July; but would be within* 13 000 000 *of miles of the earth October* 19, *with a full minute's parallax, if it's perihelion is November* 27; *or have* 3′½ *parallax May* 4, *at* 4 000 000 *of miles diſtance, if it's perihelion is March* 27.

OF THE
DISCOVERIES
CONCERNING
COMETS.

THOUGH the ancients knew little of the uſe of conick ſections, in compariſon of what has been diſcovered within theſe laſt hundred and fifty years, yet they applied them ſelves to the ſtudy of their properties, and thereby prepared the way for the readier applying them to the uſes lately found out. If thoſe who at that time employed themſelves in making aſtronomical obſervations, had been as careful in attending to the motion of comets, which do not require ſuch depth of thought as abſtruſe mathematical problems; though they knew too little then of the principles of motion to have found out their real path, yet probably we ſhould not have been ſo much at a loſs, as we ſtill are, as to their periods; but, by comparing their motions in different returns, even though the obſervations had been but groſs, might have arrived to a conſiderable perfection in the aſtronomy of comets. But as moſt of their periods ſeem to be very long, and it is but a little while that their motions have been carefully watched, it may be ſome ages yet, before we get any great knowledge about them. Moſt of the ancients, being of Ariſtotle's opinion, that comets were only inflamed vapours, raiſed, continuing, and diſperſed in our atmoſphere, took little further notice of them than as omens, often mentioning neither the time of year, or place they were ſeen in; and unleſs *both* are known, we can neither find their orbit, nor compare them with that of any known comet. Seneca indeed, and ſome others whom he mentions, believed comets to be *laſting heavenly bodies*, Nat. Quæſt. VII. 3 & 22. that *multitudes of them, which could not be ſeen on account of their poſition, kept on their ſtated courſe, and at certain times, when they got to the* *nearer end of their path, came within ſight of men*, Chap. 13, 17, 19. and he expected that *time and pains would diſcover what was then unknown, and poſterity wonder that they did not know ſuch plain things*, Chap. 25. In theſe ſeveral places there is a better gueſs about comets, than any made for above fifteen hundred years afterward: and further ſearch has ſince confirmed what he thought, that it is the excentricity of their orbits which occaſions their being only now and then ſeen. In all thoſe dark ages, from the decline of the Roman empire to the Reformation, comets being only conſidered as ominous meteors, three only have been yet found deſcribed enough to determine their orbits, and thoſe but in a groſs manner: and I think Appian was the firſt, who, about 1530, began to obſerve their motion aſtronomically; and ſoon found that, ſo far from being within our air, they, having no ſenſible parallax, muſt needs be much further off than the moon: here then is the firſt ſtep toward finding out the true nature of comets; and from that time all aſtronomers have allowed their place to be among the planetary orbits, and many obſervations were made of their motions by Tycho Brahe and others.

The two comets of 1664 and 65, coming within a few months of one another, made many perſons very inquiſitive about them; and in Birch's hiſtory of the Royal Society, Vol. II. there are two remarkable gueſſes, both read May 23, 1666. In page 93, are *Mr. Hooke's remarks on Monſ. Petit's diſſertation on the nature of comets, preſented to the ſociety ſome weeks before.* What that paper contained does not fully appear; but Mr. Hooke ſaid, *the hypotheſes were very ingenious, and ſome of them not improbable*, but whether the *comets were moved in equal ſpaces of a curve line in equal ſpaces of time, which Monſ. Petit ſeemed inclined to believe, deſerved to be further examined.* This laſt clauſe is remarkable, and that paper, if ſtill preſerved, is worth ſearching, to ſee how near Monſ. Petit was to gueſſing the truth. The other paper, page 91, is Mr. Hooke's own, endeavouring to account for the planet's motions; where, having propoſed the reſiſtance of the æther, he ſays, *the ſecond cauſe of inflecting a direct motion into a curve may be from an attractive property of the body placed in the center, whereby it continually endeavours to attract or draw it to itſelf: for if ſuch a principle be ſuppoſed, all the phænomena of the planets ſeem poſſible to be explained, by the common principle of mechanick motions; and poſſibly the proſecuting this ſpeculation may give us a true hypotheſis of their motions.——By this hypotheſis the phænomena of the comets as well as of the planets may be ſolved, and the motion of the ſecondary as well as of the primary planets: the motion alſo of the progreſſion of the auges is very evident.* This I think was much about the time that Sir Iſaac Newton diſcovered the property of gravity, and ſeems much like it; only Sir Iſaac, being the deeper mathematician, proſecuted the matter further, and cleared it up more fully.

Hevelius was too good an aſtronomer, not to ſee that comets were far diſtant from the earth, and in his Cometographia, Book III. p. 149—164, largely ſhews the abſurdity not only of ſuppoſing them in our air, but even below the moon, from the vaſt parallax they would have, and the various places they muſt needs be ſeen in at different times of day, as they riſe toward the zenith, or deſcend to the horizon: yet could he not ſhake off the eſtabliſhed opinion that they were meteors; but, to reconcile both, ſuppoſes comets to be vapours collected near any of the planets, whirling round about it till thrown out of the atmoſphere, and then moving in a ſtraight or curve line till diſperſed, Book VII. p. 384; that *comets are not ſpherical, but round and flat*, p. 338; and, from the time they leave the planet's atmoſphere, *always turn one flat ſide toward the Sun*, p. 666; and though, Book IX. p. 591—632, he calculates the places of ſeveral comets, as if moving in a ſtraight line, and generally comes nearer the obſerved place, than I ſhould expect ſuch an hypotheſis to do; yet he thinks that *their courſe is not really ſtraight*, p. 588; and in more largely treating on the ſubject, ſays, *it is a Parabola*, p. 659. It may ſurprize thoſe who have not read Hevelius, to hear that he firſt ſaid a comet's orbit is parabolical, a diſcovery generally attributed to Sir Iſaac Newton; and indeed not without reaſon, for Hevelius did but gueſs it, and knew not the principle on which its motion depended, but it was Sir Iſaac Newton who firſt proved it, and accounted for its motion in that curve, from that univerſal principle of Gravity, on which the motion of all the heavenly bodies depend. We may however give Hevelius his due praiſe as a good aſtronomer, and by a ſhort extract from his Cometographia, Book IX. ſhew how nearly he gueſſed at the true motion of comets, without knowing, or even ſuſpecting, the real cauſe which kept them in ſuch a trajectory. A comet then, he ſays, “ by no means moves in a ſtraight line, but in a curve, always “ concave toward the ſun,” p. 658, that is, “ *in a Parabola*,” p. 659: this he illuſtrates by “ the parabolick motion of projectiles,” p. 660. He ſeems here to be got very near the point, yet ſhews afterward he did not think of gravity as the cauſe of a comet's parabola: for “ as projectiles “ move in a parabola, from a compound of their progreſſive motion and “ gravity, ſo comets alſo have a double motion; one the force given them “ at leaving the planet's atmoſphere, the other not gravity, yet ſomething “ not unlike it, by which comets turn one of their flat ſides toward the “ ſun, as the center of our ſyſtem, p. 666, as a magnetick needle points “ toward the North, or toward a loadſtone. And as in projectiles gravity, “ ſo in comets the inclination of their flat ſides, turns them out of their “ ſtraight courſe,” as a rudder turns about a ſhip, which he had before largely conſidered, p. 570—587. “ And the farther a comet gets from “ the ſun, the more will its flat ſide be oppoſed to its motion, which will “ not only more and more retard its ſwiftneſs, but turn it out of its ſtraight “ courſe, p. 667. But a comet differs from a projectile, in that a body “ thrown up moves ſloweſt at the vertex of its parabola, and ſwifter both “ in riſing and falling; while a comet moves ſwifteſt at the vertex, where

" a line from the ſun is perpendicular to its path, and ſlower both in " approaching the ſun and retiring from it, p. 669. If you aſk whether " a comet's path is not an hyperbola," he " will not deny it: it is neither " circle nor ellipſis, but may be any other ſection of a cone, which is " moſt bent in the middle, and ſtraighter at each end: yet is ſatisfied it " is rather a parabola than an hyperbola," p. 683. Laſtly, " as the " planets regard the ſun as their center, ſo the comets alſo obey it in their " way," p. 701. We ſee here that Hevelius, whether by a mere gueſs at what he thought muſt needs follow from his notion of comets being flat bodies, generally ſtanding oblique to the path they move in, or finding ſuch a motion to agree beſt with his obſervations, came very near to what has ſince been found to be the truth: that comets move in a parabola, concave toward the ſun, ſwifteſt at the vertex, that is, when they are neareſt the ſun, and their motion perpendicular to a line from it, and that it is an action of the ſun on comets which makes them turn out of a ſtraight line into a curved trajectory. So far he is right, and ſeems got near the point, but is defective in not ſuſpecting the ſun to be the parabola's focus, expreſsly denying their moving in an ellipſis, and conſequently returning again; and the doctrine of gravity being a later diſcovery, he is forced to account for their curve another way. We may learn alſo from his book, that ſtudies, of which we do not at firſt ſee the benefit, are not therefore always uſeleſs. Hevelius made many obſervations and calculations of the motion of comets; on which if a perſon at that time had ſaid to him, *cui bono?* why ſo much time and pains ſpent on vapours, which were collected yeſterday, and will be diſperſed to-morrow? he, owning them to be nothing elſe, could not perhaps have given any ſufficient reaſon for it: yet if he and others had not taken that pains, Sir Iſaac Newton would hardly have found out their real motion; and there is a field yet open for further diſcoveries of future ages about them.

Sir Iſaac Newton having diſcovered that gravity is univerſal, and that a planet whoſe velocity was in a due proportion to its gravity toward the ſun, would revolve about it in a perfect circle; but in an ellipſis, of which the ſun is one focus, if its motion was either faſter or ſlower; on reconſidering the matter, on occaſion of that remarkable comet of 1680, he found, that, if a body is thrown with a velocity, which is to that neceſſary to keep it in a circle, *as the ſquare root of* 2 *to* 1; the ſame univerſal principle of gravity will make it move in a *parabola*, of which the ſun is the focus: and this being found agreeable to the obſerved motion of comets, has been ſince allowed by aſtronomers to be their real motion. It ſeems however not agreeable to the uniformity of the univerſe, that after a ſhort view of the ſun, they ſhould be continually flying farther off, in that wide void beyond the planetary bounds, to creep along that dark cold region for millions of years; (and in leſs time than that, they could not reach any other ſyſtem, if the parallax of the fixed ſtars be two ſeconds, which

Dr. Bradley has found it cannot exceed;) but that they ſhould rather revolve round the ſun, in certain, though long periods: and the likeneſs of the elements of ſome of the comets ſeen in different ages, make it probable they were the ſame returning again; if ſo, their trajectories are not *really parabolas*; but they ſeem a kind of planets, revolving round the ſun in *ſo extreamly excentrick ellipſes*, that, ſo far as we can ſee them, they are not ſenſibly different from parabolas, which for eaſe of calculation we always ſuppoſe them to be: and that their motion is almoſt exactly a parabola, I intend to ſhew particularly as to the comet of 1744, ſee page 14. The true motion of comets being thus known, Sir Iſaac Newton applied himſelf to find a method, by which a comet's orbit might be determined from a courſe of obſervations; and, having attempted many ways in vain, hit at laſt on one, which he has explained, Boook III. Prop. 41, *&c.* of his *Principia*, taking for his example the comet of 1680. The ſame method Dr. Halley uſed for twenty-three more, ſome accurately, others groſly, as the obſervations he met with were; and ſeveral more have been done ſince by others. From the likeneſs of the elements, ſome of theſe are ſuppoſed to be different returns of the ſame comet: firſt, thoſe of 1531, 1607, and 1682, with a period of 75 or 76 years, may be expected again about 1758: ſecondly, thoſe of 1532 and 1661, after a period of 128½ years, may probably return about 1789: thirdly, the obſervations of that in 1556 were very groſs, and thoſe in 1264 ſtill more defective, ſo that neither orbit can be ſuppoſed to be at all accurate; yet from their likeneſs, though not agreeing very well, may not unlikely be the ſame, and come again, after a period of 292 years, about 1848: laſtly, the comet of 1680 was a very remarkable one; and as at equal intervals, *A. C.* 44, *A. D.* 531, and 1106, others were ſeen in ſome reſpects like it, ſeveral perſons have ſuppoſed they might be the ſame, being 575 years going round the ſun; yet, no obſervations being made at any of the three former times, it was but a gueſs; and if the comet of 1106 was ſeen in March in Cancer, as the manuſcript Mr. Dunthorne mentions, Phil. Tranſ. XLVII. p. 287, ſeems to ſay, it could by no means be the ſame as that of 1680, which cannot get beyond Taurus in March, nor be ſeen in Cancer after December; the period therefore of that comet muſt remain doubtful, till further light appears.

It may be objected, that the two periods of the comet of 1682 being a whole year different one from the other, there is no knowing when to expect it again. The difference indeed is very great, conſidering how true the planet's motions are found to be; yet I fear we muſt not expect the ſame regularity in a comet's orbit as in a planet's, they being ſubject to many greater errors: firſt, croſſing all or moſt of the planet's paths, they may come nearer to one or other of them than any of the planets do to each other, and be more affected by their mutual attraction; eſpecially if near Jupiter or Saturn, the greatneſs of which bodies, weaker power of the ſun, ſlowneſs of their motion, and conſequent long continuance near one another, and direction of the comet's path nearly toward the ſun, all join to make the alteration of its orbit more ſenſible: 2dly, a ſmall change of angle will make little difference in a planet's orbit, which is always nearly perpendicular to the ſun; but when a comet's path makes only five or ten degrees angle with a line from the ſun, a little variation will bear a greater proportion to that ſmall angle, than to 90 degrees: 3dly, as a comet's greateſt diſtance is many times its leaſt, if by a planet's attraction the perihelion is altered but a few miles, that may be greatly multiplied in the aphelion; and if the angle at firſt is changed but one minute, it may make a great alteration of length, in running four times as far as Saturn, and back again: 4thly, there is but little difference in the velocity of a body, going round the ſun in one or two hundred years, and of one keeping a perfect parabola; ſmall therefore muſt be the difference of one revolving in 75 or 76 years, eſpecially if the ſame power, which increaſes its velocity, ſhould make its perihelion diſtance greater. Now the comet of 1682, in its deſcent toward the ſun, may be near Mars, but that being ſmall will hardly affect it much; again, in going from the ſun, it may paſs near Venus, a little before it gets to the deſcending node, and near the earth a little after it: if then one or more of theſe planets ſhould be in that part of their orbit when the comet paſſes by, they may make ſome change in its motion. The comet of 1680 is very liable to alteration, as in its deſcent it may paſs not remote from any of the planets, extremely near the earth, and but a little way from Venus; its motion alſo being all the time almoſt directly toward the ſun, and its perihelion diſtance ſo very ſmall, a little change in its motion might make a very great one in its orbit.

The method Sir Iſaac Newton gives, in his *Principia*, is from three obſervations of a comet, at proper intervals, to find its real trajectory; and Book III. Prop. 41, he has explained in order the ſeveral proceſſes, deſigned chiefly for conſtruction, which was the way he uſed in his example of the comet of 1680. This operoſe problem Dr. David Gregory has more fully explained and demonſtrated, in the fifth book of his aſtronomy: it may alſo be reduced to triangles, and calculated by numbers, which is much more accurate than conſtruction by lines; and though conſiſting of about an hundred triangles, Dr. Halley undertook it for 24 comets, as others have ſince for 20 more; and ſome of them, by greater care or nicer obſervations, to a very great degree of exactneſs. Yet as a compleat liſt of the triangles uſed, and ſeveral cautions neceſſary in practice, are not publiſhed, I have choſen to ſet them down here, not generally repeating the demonſtrations, which Sir Iſaac Newton and Dr. Gregory have already done, but ſuppoſing one of thoſe books at hand, to add ſome obſervations for preventing miſtakes, and ſhewing how it may be reduced to triangles: the letters here uſed are the ſame as in Sir Iſaac Newton, except ſome few which he had not, and are generally thoſe which Dr. Gregory uſes.

He then who would calculate a comet's orbit by triangles, ſhould firſt conſtruct it as true as may be by lines; for as the method is approximation, it is to no purpoſe to calculate nicely, while the point tried is much wrong, as the firſt gueſs will moſt likely be; and as the accuracy depends on having, in fig. 2. B near μ, (ſee Greg. V. 18, 19.) he cannot at firſt chuſe ſuch obſervations as will make it ſo. Firſt therefore, out of a ſet of obſervations on a comet, chuſe three ſo that you gueſs that interval of time when the comet was neareſt the ſun is the ſhorteſt, but no great nicety is required this firſt time. On a large ſheet of paſteboard, draw a circle ten inches radius for the *magnus orbis*; mark the points the earth was in at the three times of obſervation, and call them T, t, and τ, (ſee fig. 1); from theſe draw the three obſerved longitudes of the comet, TA, tB, and τC: on tB take any point B; let V be the interſection of St and $T\tau$, and γ the place the comet was in perpendicularly over B; make $S\gamma^3 : SB \times R^2 :: tV : BE$, which ſet off on the line SB: through E (Newton's *Princip.* III. lemma 7.) draw AC cutting TA and τC, ſo that $AE : EC$ as the time between the firſt and ſecond obſervations, to the time between the ſecond and third. A and C are near enough for the firſt trial, the curtate places of the comet in its orbit. To try how true they are, let TA be to the perpendicular AM, as radius to the tangent of the comet's apparent latitude the firſt time, and $\tau C : CN :: R :$ tang. of apparent latitude the laſt time, and draw MN the chord of the parabolick arc $M\gamma N$, along which the comet moved, while the projection of the points on the ecliptick are A, B, C: then ſay $SB : S\gamma :: SB + \frac{2}{3}BE$ to a fourth number, nearly equal to (SR, ſee Greg. V. 20.) the diſtance from the ſun at which a comet would move the chord MN, in the ſame time as it really did go the arc $M\gamma N$: let X be the length run by a comet at the earth's mean diſtance from the ſun, in the time between the firſt and third obſervations (Newt. *Prin.* III. 40.) then $\sqrt{SR} : \sqrt{\text{radius}} :: X : MP$, being the length a comet would go in the ſame time at the height SR. If MN be equal to MP, the point B was taken right; but if very different, as may eaſily be this firſt time, take a new point b, find ac, and try till MN is nearly equal to MP. Being now near the matter, we muſt be more exact: biſect the trueſt AC in I, (ſee fig. 2.) erect a perpendicular $Ii = Bb$, draw Si, and erect $\lambda\mu$: if μ falls on or near B, the obſervations are rightly choſen; if not, take one or more new obſervations, to make B as near as poſſible to μ, and rather between i and μ than otherwiſe, (Greg. V. 18, 19.)

The circle drawn for the *magnus orbis* will do again, as will T, t and τ, if carefully drawn as to angle and diſtance, and the ſame obſervations are ſtill uſed; as alſo the three longitudes TA, tB, and τC. Set off tB as near as now known, draw AC as before, biſect it in I, erect the perpendicular $Ii = Bb$, (ſee fig. 2.) compleat the rectangle $Ii\lambda\mu$, and μ is nearly the vertex of the parabolick arc ABC; (Greg. V. 19. coroll.) but may be further corrected thus. Produce $I\mu$ to η, ſo that $\mu\eta = \frac{1}{2} I\mu$; through S draw $\eta\xi = 3\,S\eta$, in the line $B\xi$ take a new point E', and if the former length BE is not true enough, which yet it will generally be for conſtruction, a truer length for BE' may be found, as directed preſently for calculation, thus: a ſidereal year is to the time between the firſt and third obſervations, as the circumference of a circle to the length of the mean arc the earth moves in that time; the ſquare of half that arc divided by twice the radius, is the fall of the earth in half the time: this, if now done accurately, need not be repeated in N°. 7 of the calculation: then $SB : S\gamma :: SB + \frac{1}{3} I\mu : SL$ and $SL^3 : R^2 \times \overline{SB + \frac{1}{3} I\mu}$ :: the fall of the earth : BE' the fall of the comet. Through E' draw $A'C'$, and form the rectangle $I'i'\lambda'\mu'$, μ' is the vertex of the parabolick arc, (Greg. V. 19. coroll.) and $B\xi$ divides the chord very nearly in proportion to the times (V. 18). It remains then to try whether the point B was gueſſed right: ſay then $SB : S\gamma :: S\mu' + \frac{2}{3} I'\mu' : SR$, and as above find MN and MP: if they are not equal, draw GP parallel to $C'N$, then is $C'G$ the error; take a new length tb, and repeat the proceſs to find a new mn and mp, and error $c'g$. The two figures 3, which are the ſmall part YCG of fig. 1 and 2, ſhew the two caſes of this correction, when C and c are on the ſame or oppoſite ſides of z; where a line drawn through G and g the two points of error will cut YC, that is in the point the comet was really over, when, by a wrong gueſs at the length tB and tb, it came out C and c; and ſetting off $A'F$ and $a'f$ equal to $C'G$ and $c'g$, the true point x may be in like manner found. We may now either proceed to calculate the orbit arithmetically, from the length of tB now very nearly known, or find the elements of the orbit by conſtruction thus; (ſee fig. 4.) two points of a parabola m and n, perpendicularly over the curtate places x and z, with the focus the ſun, determine the whole curve: draw then xz, and erect two perpendiculars xm and zn, the tangents of the comet's latitude at the firſt and third obſervations, Tx and τz being the radii; S☊ drawn through the ſun and the interſection of xz and mn, is the poſition of the comet's node. $z\varrho$ a perpendicular let fall from z on S☊, is to zn the tangent of its latitude, as radius, to tangent of the inclination of the orbit. Produce the perpendiculars $x\sigma$ and $z\varrho$ to m and n, as coſine of inclination to radius, which will be in that poſition to each other, the ſun and line of nodes, as the comet was in its orbit at the firſt and third obſervations; on m and n (fig. 5.) with radius Sm and Sn draw two circles; a tangent to both circles may be drawn by the eye, or thus, biſect mn, draw a circle on that center paſſing through m and n, and ſet off $m\iota = n\gamma = Sn - Sm$, which produce to δ and κ; $\pi\kappa\delta$ being parallel to $m\gamma$, which is perpendicular to both radii $m\kappa$ and $n\delta$, touches both circles, and $S\pi$ a perpendicular on it from S, is double the perihelion diſtance: (De la Hire's plain conicks.) Wherefore P, the biſection of $S\pi$, is the vertex of the parabola or perihelion point, whoſe poſition is determined by the angle nSP or mSP; as is the time the comet was there, becauſe the parabolick ſpace nSm, is to the parabolick ſpace mSP, as the time between the obſervations, to the time between the perihelion and firſt obſervation.

Thus are the elements of a comet's orbit found by conſtruction; but if exactneſs is required, lines will not do it, but the proceſs muſt be reduced to triangles, and calculated by numbers. And firſt ſee that the obſervations are good, or elſe be content with conſtruction, for it is to little purpoſe to calculate nicely by uncertain data. Next try whether the times are rightly choſen, by the directions already given, (ſee page 7.) and, for further accuracy, be not content with the earth's places as found by the tables of the ſun, but correct them by the menſtrual parallax. The weight of the earth being to that of the moon as 39.788 to 1, the diſtance of the moon, is to the diſtance of the common center of gravity, as 40.788 to 1. (Newt. *Princ.* III. 37. cor. 4 and 6.) In fig. 6. E is the earth, and M the moon, revolving round C their common center of gravity which moves regularly along the *magnus orbis* ACB round the ſun S; then at any time the ſine of the moon's horizontal parallax, is to the ſine of the ſun's parallax divided by 40.788, as SC to CE. In the triangle SCE, given SC, CE and SCE, then CSE is the required correction of the ſun's place, and SE the real diſtance of the earth from the ſun. This triangle however need not be ſolved, the tables IV. and V. giving the required correction in angle, and the length of the line ED, to be added to or ſubſtracted from SC, the diſtance of the ſun as found by the common tables. As the moon has ſometimes above five degrees of latitude, and therefore the earth is not abſolutely in the plain of the ecliptick, for perfect exactneſs that ſhould be allowed for; but as the whole menſtrual parallax is very ſmall, this, which is but a ſmall part of it, may I ſuppoſe be ſafely neglected. Laſtly, before calculating, draw a ſet of figures ſuited to the particular caſe, for no general rule can be given where to add and where ſubſtract; the caſe I have drawn, and ſuited the *plus* and *minus* to, is the comet of 1742; and another ſet of figures will ſhew, whether to add or ſubſtract in that caſe. Thus prepared, the following is a liſt of the triangles required, what is given and what is ſought, for fixing the due length of the lines, which determine the comet's trajectory.

N°.	Triang.	Given.	Sought.	Remarks.
1	$ST\tau$	ST, $S\tau$, and $TS\tau$	$ST\tau$, $S\tau T$, [and $T\tau$]	$ST\tau - STY = \tau TY$. [$S\tau T - S\tau Y = T\tau Y$
2	$TY\tau$	$T\tau$ and τTY (N°. 1) and $TY\tau$	TY and τY	See fig. 1.
3	StB	tB (a gueſs) St and StB	tSB and SB	$tS\tau + tSB = DS\tau$
4	$tB\gamma$	γ perpendicularly over B	R : tang. ap. [Lat.:::tB:$B\gamma$	
5	$SB\gamma$	SB (N°. 3) $B\gamma$ (N°. 4) $SB\gamma = (90°)$	$S\gamma$	[Conſtruction
6		$SB : S\gamma :: SB + \frac{1}{2} I\mu$	$: SL$	$I\mu$ taken from the laſt
7		$365.256 : U + W :: 2R \times 3.14159$	$: \chi \dotplus \omega$	$\frac{\overline{\frac{1}{2}\chi \dotplus \omega^2}}{2R} = \frac{\gamma}{2} \dotplus$. Greg.I.25. [cor. 1.

N°.	Trian.	Given.	Sought.	Remarks.
8		$SL^{3} : R^{2} \times \overline{SB + \frac{1}{3} I\mu} :: \zeta$ ⫰	: BE	
9	DSτ	Sτ, SτD and DSτ (N°. 3)	SD and τD	SD + BE − SB = DE
10		W : U + W :: DE	: DQ	AH equal and parallel to [DQ
11	AHY	AH (N°. 10) AYH and AHY (N°. 9)	AY and HY	τD + HY − τY = HD
12		U : U + W :: HD	: HC	
13	ACH	AH, HC and AHC	ACH, CAH, [and AC	AYC + ACH + YAC [= 180°
14		U + W : U :: AC	: AE	
15	BE*b*	BE (N°. 8) B*b*E (= 90°) BE*b* (= SDτ — ACH)	B*b* = I*i*	See fig. 2.
16	SEI	SE (= SB — BE) IE (= $\frac{1}{2}$AC — AE) SEI (N°. 15)	SIE and SI	SIE + 90° = SI*i*
17	SI*i*	SI, I*i* (N°. 15) and SI*i*	S*i*I	
18	I*i*λ	I*i*, I*i*λ (N°. 17) *i*Iλ (= 90°)	*i*λ = Iμ	Iμ × 1.5 = Iη
19	SIμ	SI (N°. 16) Iμ and SIμ (= SIE + Iλ*i*)	Sμ	
20	SIη	SI, Iη (N°. 18) and SIη	ηSI and Sη	2Sη = Sξ. ηSI − ISE = ηSE [the Suppl. of BSξ
21	SBξ	SB, Sξ and BSξ	SBξ	Greg. V. 18.
22	BDD	BDD′ (N°. 9) DBD′ (= SBξ) BD (= SD — SB)	BD′ and DD′	
23		SB : Sγ :: Sμ + $\frac{1}{3}$ Iμ	: SL	Greg. V. 21.
24		$SL^{3} : R^{2} \times \overline{S\mu + \frac{1}{3} I\mu} :: \zeta$ ⫰	: BE′	BD′ + BE′ = D′E′
25	SE′B	SB, BE′ and SBE′ (N°. 21)	SE′ and BSE′	
		Repeat 10 — 19 to find A′C′, SI′, I′μ′ and Sμ′		
(11) 27		A′H′Y = BD′D (N°. 22)		τD + H′Y − τY − DD′ [= H′D′
(15) 31		BE′*b*′ (N°. 22 and 29)		
(16) 32		SE′ (N°. 25) SE′I′ = Suppl. BE′*b*′	+ SBξ + BSE′	
36		Sμ′ : Sμ′ + $\frac{1}{3}$ I′μ′	: Sρ ÷	
37		SB : Sγ :: Sρ	: SR	
38	TA′M	R : tang. Lat. :: TA′	: A′M	
39	τC′N	R : tang. Lat. :: τC′	: C′N	
40	MKN	MK (= A′C′) KN (= C′N — A′M) MKN (90°)	MN	
41		$\sqrt{SR}$ (N°. 37) : $\sqrt{R}$ :: χ ⫰ ω (N°. 7)	: MP	Greg. I. 42. and V. 20.

If MN = MP, M and N are two true Points in the comet's orbit, proceed therefore to N°. 89; and thence find the elements; but if not equal, take a new point *b*, ſo that

$$\left.\begin{array}{l} MN : MP \\ \sqrt{S\gamma'} : \sqrt{S\gamma} \end{array}\right\} :: Ye : Ye',$$

and repeat the whole proceſs, except N°. 1, 2, and 7.

80		MN : NP :: A′C′	: C′G = A′F	
81		*mn* : *np* :: *a*′*c*′	: *c*′*g* = *a*′*f*	See fig. 3.
82	*c*′*pg*	*c*′*g*, *c*′*pg* (= A′C′H′ N°. 29) *pc*′*g* (N°. 67)	*c*′*p* and *pg*	YC′ — Y*c*′ ∓ *c*′*p* = C′*p*
83		C′G ± *pg* : C′*p* :: C′*g*	: C′*z*	τC′ — C′*z* = τ*z*
84 85	}	In like manner find A′*x*		TA′ — A′*x* = T*x*
86	T*xm*	R : tang. Lat. :: T*x*	: *xm*	
87	τ*zn*	R : tang. Lat. :: τ*z*	: *zn*	
88	*x*Y*z*	Y*x* (= T*x* — TY) Y*z* and *x*Y*z*	Y*zx* and *xz*	
89	ST*x*	ST, T*x* and ST*x*	TS*x* and S*x*	
90	Sτ*z*	Sτ, τ*z* and Sτ*z*	τ*z*S and S*z*	τ*z*S — Y*zx* = S*zx*
91		(*zn* — *xm* =) *rn* : *rm* :: *zn*	: *z*☊	See fig. 4.
92	S*z*☊	S*z* (N°. 90) *z*☊ and S*z*☊ (N°. 90)	*z*S☊ and S☊	τS*z* — *z*S☊ = τS☊. [Place of the Node.
93	S*z*ρ	S*z*, *z*Sρ and Sρ*z* (= 90°)	*z*ρ	
94	*nz*ρ	*z*ρ, *zn* and *nz*ρ (= 90°) *z*ρ : *zn* :: R	: tang. *z*ρ*n*	Inclination of the Orbit.
95	S*xm*	S*x*, *xm* and S*xm* (= 90°)	S*m*	
96	S*zn*	S*z*, *zn* and S*zn* (= 90°)	S*n*	
97	*rmn*	*rm* (N°. 88) *rn* (N°. 91) *mrn* (= 90°)	*mn*	
98	S*mn*	S*m*, S*n* and *mn*	S*nm* and *m*S*n*	See fig. 5.
99	*mn*γ	*mn*, *n*γ (= S*n* — S*m*) *m*γ*n* (= 90°)	*mn*γ	180° — S*nm* — *mn*γ = *n*SP

N°.	Triang.	Given.	Sought.	Remarks.
100	S n ☊	S n, S ☊ (N°. 92) S n ☊	n S ☊	nSP − nS☊ = PS☊. Perihelion from [Node.
101	S n θ	S n, n S θ, and S θ n (= 90°)	S θ	$\frac{\theta\pi + S\theta}{2} = SP$. Perihelion Diſtance.
102		Parabolick ſpace PSn − PSm, is to PSm, as time between the obſervations, to time between the Perihelion and firſt obſervation		Time of Perihelion.

N. B. The parabolick ſpace may be either taken out of the table of the parabola, or calculated in the ſame manner that was done.

N°. 7. I call the time between the firſt and ſecond obſervations U, and that between the ſecond and third W. Then a ſidereal year is to the whole time, as the circumference of the circle to the arc moved in that time: and the ſquare of half that arc, divided by twice the radius, is the earth's fall toward the ſun in half the time.

N°. 6, 7, 8. I find B E this way rather than Sir Iſaac Newton's, which is only an approximation, and irregularly too great or too ſmall, as the times are more or leſs unequally divided, and T t τ in the more or leſs curved parts of the earth's orbit. But this way, if found as in N°. 23, 24, would be true; and Sμ being not yet known, I uſe S B for it, which is very nearly the ſame: nor is Iμ yet found, but as the comet has been already conſtructed, it is there given near enough for this proceſs.

N°. 20. Since, by Greg. V. 18, the right line $n S \xi = 3 S n$ is the truth, full as eaſy, and, requiring no taking out natural numbers, is leſs liable to error, I wonder Sir Iſaac choſe to approximate it by the point σ, and $\sigma\xi = 3 S\sigma + 3 i\lambda$. (See his fig. Book III. Prop. 41.)

N°. 23, 24. In Greg. V. 21, the comet's fall at the height S L is M V = V Z, (ſee his fig.) Now B and μ nearly coinciding, by ſimilar triangles $SB : S\gamma$ (N°. 5) $:: Sl\ (= S\mu + \frac{1}{3}I\mu) : SL$. Again, $SL^2 : R^2 :: \zeta\psi$ (the earth's mean fall) : the fall at the point L. Greg. I. 42. And by ſimilar triangles $SL : S\mu + \frac{1}{3}I\mu ::$ the fall at $L : BE$; then $SL^3 : R^2 \times \overline{S\mu + \frac{1}{3}I\mu} :: \zeta\psi : BE$. This is the true length of μZ or B E, and ſeldom ſenſibly different from B E′, which yet being more perpendicular to A C, is a little ſhorter; and if B E is ſo long and ſo oblique to A C, that the very ſmall angle E B E′ will ſenſibly alter its length, then the ſine of $BE'b$: ſine of $BEb :: BE : BE'$ may be ſomething truer.

N°. 36. The third proportional to Sμ and $S\mu + \frac{1}{3}I\mu$, which is the truth, ſee Greg. V. 20, is eaſier found in Logarithms than $S\mu + \frac{2}{3}I\mu$.

N°. 37. It is here fit to ſhew cauſe for this conſiderable variation from Sir Iſaac Newton. Greg. V. 20, ſhews that a body at the height S R (ſee his fig.) would move the chord A B, while the comet really moved the arc A V B. Now μ, l and ϱ, in fig. 2, are the projection on the plain of the ecliptick of his V, L and R: then S R, the hypothenuſe of the right-angled triangle SϱR, is Gregory's line S R, and therefore the length ſought. Sir Iſaac's $ID = S\mu + \frac{2}{3}i\lambda$ is nearly the ſame as Sϱ; but his I O, being the comet's mean height above the ecliptick, may if the time is unequally divided, and the inclination of the comet great, conſiderably differ from the height ſought at $S\varrho$, which is in $S\mu$ produced: therefore, as in N°. 23, $SB : S\gamma :: S\varrho : SR$, by ſimilar triangles.

N°. 38, 39. M and N being the points the comet was really in, perpendicularly over A′ and C′, T A′, the curtate diſtance, is to A′ M the height, as radius to tang. of the apparent latitude at the firſt obſervation. The like of C′ N.

N°. 41. The reaſon of this double proportion is this: M N, and of courſe A′ C′ and the perpendicular Y *e*, is too large in the proportion of M N to M P; but M P will increaſe or diminiſh, as $\surd S\gamma'$ is leſs or greater than $\surd S\gamma$. Greg. I. 27. This however is very hard to find, and only an approximation at laſt. An eaſier and as good a way is, to compare the error of the laſt conſtruction with the error now found by calculation: thus N P — N P the difference of the errors, is to *t* B — *t* B the difference of the gueſſes, as N P the preſent error, to the required correction of *t* B.

N°. 80, 81. Sir Iſaac Newton takes C G = N P; but as the correction is in the plain of A C, not of M N, I make G the projection of P, as C is of N. And if C G is not parallel to *c g* (fig. 3.) or C *c* bears not the ſame proportion to τ C, as A *a* to T A, it may make ſome difference in the places of *x* and *z*, though ſeldom much.

N°. 80, 81, 82, 84, are not wanted if A C is parallel to *a c*; for then 83 and 85 will be, $NP \pm np : NP :: Aa : Ax :: Cc : Cz$.

Sir Iſaac Newton in his next propoſition, and Dr. Gregory V. 31, ſhew how, by the rule of falſe, to correct ſtill further the comet's orbit as above found: but that I have here omitted, as hoping and expecting that the directions I have given, being contrived to avoid all error as much as poſſible, will give the orbit true enough without that laborious correction, which I can hardly think is much leſs trouble than the calculation of the orbit itſelf. The changing the comet's *parabolick orbit* into its real *elliptical one*, by this correction, thereby to diſcover its period, can I doubt be at beſt but imperfectly done, from the ſmall part of the orbit we can ſee, eſpecially if ſo true a parabola as the comet of 1744 had: and unleſs we ſee a comet for a very long time, we muſt be content to wait for that more certain, though tedious diſcovery, the returning after another period. If any one however, deſirous of the utmoſt exactneſs, chuſes to undertake this laſt correction, Sir Iſaac Newton and Dr. Gregory have both explained and ſhewn the uſe of it.

As ſeveral perſons, eſpecially of late years, have apply'd themſelves to finding by Sir Iſaac Newton's method, the orbits of ſeveral comets, but the reſult of their labours is no-where that I know of, collected into one view, I have here made a general table of all that I have found. And as ſince 1700 many are calculated by two perſons, I ſet down both orbits, not always knowing which is beſt, and thinking it uſeful to preſerve all, to be at leiſure compared, either by obſervations already made, or by thoſe who ſhall ſee their next returns. Some of theſe different orbits vary little, as that of 1744, others differ widely, as that of 1739; probably ſometimes from defectiveneſs in the obſervations one or both of the calculators uſed. I found ſeveral difficulties in making this table, from falſe prints, and authors not being always careful to ſet down the *aſcending node*, having more than once found two perſons ſet down the ſame comet's node in the oppoſite ſigns. By comparing the orbits with the obſervations, I have aimed to avoid miſtakes, but have not met with obſervations of all of them to compare with, and leſſer errors may eſcape; if therefore the authors, or any one elſe, ſhall find any miſtake inadvertently ſlipped in, I ſhall be obliged to them for an account of it, and not fail to correct it when opportunity offers. See the liſt in table I.

The firſt 7 of theſe comets, and thoſe of 1593 and 1596, being but imperfectly obſerved, can be but groſly done; as alſo thoſe of 1678 and 1702, unleſs the calculators uſed better obſervations than I have found: that of 1533 will by no means ſuit the obſervations in Hevelius, ſo that I ſuſpect ſome miſtake or falſe print: Struijck gives the comet of 1699 from Caille, but makes the perihelion Jan. 2, and the aſcending node in ♒, which is right I do not know, any further than that I have found Caille careleſsly ſetting down the wrong node in other inſtances: not having met with the obſervations, I can ſay nothing of the accuracy of thoſe of 1699, 1706, 7, 29, 43, and 48: Downes's orbit of the comet of 1718 ſuits beſt, ſo far as I have tried it, and Caille's of 1739: none of the orbits of the comet of Jan. 1742 agree well with the ſet of obſervations in Phil. Tranſ. No. 481; mine, which was calculated from the obſervations there mentioned of Mar. 2 and 16, and Apr. 2, agrees I think as well as any of them, but generally gives the latitude too ſmall, being done a good while ago, from a more imperfect liſt of triangles than that here given in pages 9, 10, 11: C and Struijck differ 10 degrees in the node of the comet of December 1742, which is probably a falſe print, but I cannot correct it: the comet of 1747 was ſeen in Auguſt 1746, half a year before its perihelion, being then between two and three times as far from the earth as the ſun is, and between three and four times the earth's diſtance off the ſun; and its perihelion being above twice the earth's diſtance, we muſt not expect exactneſs there: Dr. Bradley's two comets of 1723 and 1737 are very accurate; as is alſo Betts's of 1744, calculated from obſervations made between Dec. 23, 1743, and Feb. 18, 1743-4; but as it was ſeen for a little while about two months before, when far diſtant from the earth, and much more from the ſun, I have compared three obſervations ſent me from Mr. Morris with Betts's orbit, and found them to agree perfectly; which proves both the truth of the elements, and that the comet's ellipſis was ſo far at leaſt inſenſibly different from a parabola; or elſe thoſe obſervations, made four months before the perihelion, and two before the obſervations the orbit was found by, would not have agreed ſo well: the hour of obſervation not being given, I have in the following table calculated for 8ʰ 17′ each evening.

Comet of 1744, *ſeen in* 1743.

	Obſervation.		Calculation.	
	Long.	Lat.	Long.	Lat.
	° ′	° ′	° ′	° ′
Oct. 22	♉ 26 . 46	N. 7 . 35	♉ 26 . 41	N. 7 . 35
27	24 . 14	8 . 28	24 . 15	8 . 31
Nov. 1	21 . 25	9 . 26	21 . 25	9 . 28

I collected theſe orbits from firſt, Dr. Halley's 24 comets, now printed in his aſtronomical tables; ſecondly, Caille's liſt in his aſtronomy, art. 560, Robertſon's tranſlation, page 236; thirdly, a collection by N. Struijck, Phil. Tranſ. N°. 492; fourthly, ſeveral ſingle ones, 1723, 37, 39, 44, and 1264, from Phil. Tranſ. N°. 382, 446, 461, 474, and Vol. 47, page 283, and Mr. G. Whiſton's of 1718, from himſelf. The reaſon of my adding and altering ſome particulars in this table are theſe: the articles uſed in calculating a comet's place are, the time of the perihelion, log. of diurnal motion, diſtance of perihelion from node, coſine and ſine of the comet's inclination, place of the node, whether direct or retrograde, and log. of the perihelion diſtance; theſe therefore are all inſerted: and ſince, notwithſtanding care, falſe prints will ſometimes creep in, and I have met with difficulties from them, I aim to frame this table ſo as to find them out. The obſervations will ſoon ſhew whether the year of the comet is right; but on the ſecond column I neither have, nor know how to find any check: the log. of the diurnal motion is found from the log. of the perihelion diſtance, if therefore theſe articles agree together, both are probably right, if they do not, the natural perihelion diſtance will ſhew which is true: the perihelion place is a fictitious thing, for its diſtance from the node is meaſured in the plain of the comet's orbit; but that, eſpecially in a very oblique comet, is by no means the ſame number of degrees on the ecliptick, except at the nodes and their perpendiculars; the only uſe therefore of inſerting it is, by comparing that, the node, and perih. poſt nod. together, to find out any falſe print: as to the ſeventh column, Dr. Halley gave the diſtance of the perihelion from the node, whether before or after; but I count the number of degrees a comet moves, from paſſing its aſcending node to its perihelion, whether more or leſs than 180 degrees; this ſaves a little trouble in computing a comet's place, as I ſhall ſhew when I come to explain that, (ſee page 18). The node, being the connexion of the plain of the eclíptick with the comet's orbit, is the key of the whole work; and whoever calculates or collects orbits, ſhould remember, that it is the *aſcend-*

ing node muſt be inſerted, and the article perih. poſt nod. reckoned from that, or elſe confuſion is cauſed, and the comet found in falſe latitude: giving the inclination of the orbit is not ſtrictly neceſſary, if its ſine and coſine are but given, which prove one another: the twelfth column needs no explaining: and in the laſt I give the calculator's name, where I know it; but as Caille names no author, thoſe taken only from him are marked C, as I can trace them no further.

Dr. Halley made a table of the parabola, for finding a comet's place at any time, printed with his liſt of orbits, and ſhewed the way of uſing it: he goes the direct way, for, dividing the firſt quadrant of the parabola into 100 equal parts, he gives the angle each is in from the vertex, and its increaſe of diſtance from the focus: but the calculation being tedious, and one ſuch part altering the angle but little, at a diſtance from the vertex, he computed every part only to 100, that is, to the *latus rectum*, and to every ſecond, fourth part, or greater interval afterwards. This table is 240 lines in all, but though very uſeful has ſome defects; for, being too ſhort, the differences are often too large, and too unequal, for finding proportional parts truly, eſpecially in the log. of the diſtance; again, proportional parts can hardly be found at the breaks, where the interval alters from 1 to 2, 4, 10, 20, 500, 40000, and 50000; laſtly, it may however ſerve as far as 1000, that is, 144°½ from the perihelion, which is far enough for many comets, but thoſe whoſe perihelion diſtance is ſmall, are ſeen much further; that of 1680 goes near 162°¾ within four days after its perihelion, and may be ſeen to about 174°, this table therefore will by no means do for that. Finding theſe inconveniences, and not caring for ſo difficult a calculation as Dr. Halley's, I thought of interlining his table by the differences, but found it very troubleſome; and being adviſed to make a new table, on an eaſier plan, to find the diſtance and ſpace from the angle, I conſidered it, and found the demonſtration plain, the calculation very eaſy, the method ſuch as might be carried on regularly, from beginning to end of the table, and having finiſhed it, the differences were more regular than I expected; for proportional parts will determine to about half a ſecond, the angle the comet of 1680 is in from the ſun, at the greateſt diſtance we can ſee it, and the log. of diſtance almoſt to perfect exactneſs, in any part of the table. The principles of this method may be ſeen in fig. 7. and let R ſtand for radius, *s* for ſine, and *v* for verſine.

$$(1)\ \begin{cases} SC = ST = SR & \text{De la Hire's plain conicks.} \\ Sc = St = Sr & \text{Parabola, Prop. 4, cor.} \end{cases}$$

$$(2)\ \left\{\begin{array}{l} PQ = PT = SC - SP = \varrho - 1 \\ Pq = Pt = Sc - SP = \varrho - 1 \end{array}\right. \quad \text{Prop. 7.}$$

$$(3)\ RQ = rq = 2SP \quad \text{Prop. 9.}$$

$$(4)\ SmnP = \tfrac{2}{3}\overline{Sm \times SP} = 1.3 \quad \because 1 = \tfrac{3}{4} SmnP$$

$$(5)\ \left\{\begin{array}{l} RQ : SC :: v.\ \text{of}\ RSC : R \\ rq : Sc :: v.\ \text{of}\ rSc : R \end{array}\right. :: 2 : \varrho = \frac{2}{v} \quad \text{(See 1. and 3.)}$$

$$(6)\quad \mathrm{R} : s :: \varrho : \sigma = \varrho s$$

$$(7)\quad \begin{cases} \mathrm{SC}m\mathrm{P} = \tfrac{1}{2}\overline{\mathrm{SP} + \tfrac{1}{6}\mathrm{PQ}} \times \sigma \\ \mathrm{S}cn\mathrm{P} = \tfrac{1}{2}\overline{\mathrm{SP} + \tfrac{1}{6}\mathrm{P}q} \times \sigma \end{cases}$$ Quadrature of parabola.

$$(8)\quad \begin{cases} \tfrac{3}{4}\mathrm{SC}m\mathrm{P} = \dfrac{3\,\mathrm{SP} + \mathrm{PQ}}{8} \times \sigma = \dfrac{3 + \varrho - 1}{8} \times \sigma = \dfrac{2 + \varrho}{8} \times \sigma \\ \tfrac{3}{4}\mathrm{S}cn\mathrm{P} = \dfrac{3\,\mathrm{SP} + \mathrm{P}q}{8} \times \sigma = \dfrac{3 + \varrho - 1}{8} \times \sigma = \dfrac{2 + \varrho}{8} \times \sigma \end{cases}$$

ϱ may be found a little eaſier thus, by fig. 8.

$$(9)\quad \mathrm{SB}^2 = \mathrm{AB} \times \mathrm{VB} = 2\mathrm{R}v$$ by ſimilar triangles.

$$(10)\quad \mathrm{SM}^2 = \frac{\mathrm{R}v}{2} = s^2 \text{ of } \tfrac{1}{2}\mathrm{SCB}$$

$$(11)\quad \frac{\mathrm{R}}{\mathrm{SM}^2} = \frac{2\mathrm{R}}{\mathrm{R}v} = \frac{2}{v} = \varrho$$ as before found.

Examples of the firſt method.

Angle from aphelion	112°.55′		65°.50′	
2	0.3010300		0.3010300	
v	0.1428248		9.7712991	
$\sigma \begin{cases} \varrho \\ s \end{cases}$	0.1582052 = 9.9642937	1.4394 2.	0.5297309 = 9.9601655	3.3863 2.
$2 + \varrho$	0.5364926	237	0.7312940	55
Ar. Comp. 8.	9.0969100	126	9.0969100	81
$\mathrm{S}cn\mathrm{P}$	9.7559015	302	0.3181004	129
		99		34

Examples of the latter method.

Angle $r\mathrm{S}c$ 122°.45′			Angle RSC 61°.10′	
$\dfrac{\mathrm{R}}{\mathrm{SM}^2}$	1.2978		3.8629	
	0.1132346		0.5869212	
$s.$	9.9248161	268	9.9425171	77
$2 + \varrho$	0.5182349	132	0.7681176	74
Ar. Comp. 8.	9.0969100		9.0969100	
		334		112
$\mathrm{S}cn\mathrm{P}$	9.6531956	106	0.3944659	51

This method of calculation, by which the parabolick table, N°. II. is made to every fifth minute of angle, ſuppoſes, as is the natural and regular way, that the parabolick ſpace at 90 degrees from the vertex is 1, and ſo I ſhould have entered it in the table, had I been to chooſe; but Dr. Halley having divided that ſpace into 100 parts, and fitted the log. of diurnal motion and method of reckoning to that, I have, to avoid confuſion, ſuited my table to his, by adding two to the index of the ſpace as above found. The log. of diſtance proceeds regularly all the way, with increaſing differences; but one break was neceſſary in the mean motion, for the log. of ſpace is extreamly unequal near the perihelion, as is the natural ſpace at a great diſtance from it; the firſt 45 degrees therefore is the natural ſpace, and the reſt of the table its logarithm: yet no difficulty can hence ariſe, ſince both are very regular where the table alters. As the differences increaſe very faſt toward the end of the table, No. III. ſhews how near proportional parts will give a comet's real angle and diſtance: 45 degrees from the perihelion is tried, becauſe there the differences of the log. of mean motion decreaſe, while thoſe of the log. of diſtance increaſe, yet no ſenſible error does thence ariſe: few comets are ſeen above 155 degrees, nor that of 1680 more than about 174 degrees from the perihelion. The two firſt columns are the angle, and true log. of mean motion; the third is the angle which proportional parts would give as anſwering to that logarithm: for inſtance, 7.522283 is the true log. of mean motion for 178°.57′.30″, but proportional parts would give 178°.57′.27″ for it, that is 3″ wrong; and 7.523327, the arithmetical mean between the mean motion at 178°.55′ and 179°, would be called the log. of mean motion for 178°.57′.30″. The fourth column is the true logarithm of diſtance; and the fifth what logarithm of diſtance proportional parts would give, as anſwering to the true log. of mean motion: and though the differences increaſe ſo greatly toward the end of the table, yet as both log. of mean motion and log. of diſtance increaſe proportionally, no error is thereby cauſed; and this is the caſe uſed in calculating a comet's place: but if on any other occaſion, the log. of diſtance at any certain angle is required, the ſixth column gives the log. of diſtance found by equal diviſions, the ſeventh its error, and the eighth how much that point of the parabola is by this error carried too far from the focus: for inſtance, 2.115806 is the true log. of diſtance at 169°.57′$\frac{1}{2}$, by equal diviſions 2.115813 will be found for it, which is 7 too much, and that point is by this means made $\frac{1}{50000}$th part too far diſtant from the focus; this is the greateſt error between 169°.55′ and 170°, for if tried at 169°.56′, 57′, 58′, or 59′, the error is leſs. We ſee then that in the caſe of computing a comet's place, this table will never err more than half a ſecond in angle, (much nicer than any orbit is known,) and in all places gives the log. of diſtance true.

Since the velocity of a body moving in a parabola, is to that of one moving in a circle, as $\sqrt{2}$ to 1, (Newton's *Princ.* I. 16, cor. 7.) the periodical time of a planet, is to the time a comet of equal perihelion diſtance takes to go its firſt quadrant, as the area of the circle $= 1 \times 3.14159$, to the area of that quadrant divided by the $\sqrt{2}$, that is, $\frac{1 \times \frac{4}{3}}{\sqrt{2}} = 1 \times \frac{2}{3} \times \sqrt{2}$; and is therefore thus found, in a comet whoſe perihelion diſtance is the radius of the *magnus orbis*:

$$3.14159 : \tfrac{2}{3}\sqrt{2} :: 365^{d}.6^{h}.9'.12''\ (365.25639) : (109.61543)\ 109^{d}.14^{h}.46'.13''.$$

365.25639 =	2.5625978
√2	0.1505150
2	0.3010300
3	0.4771212
3.14159	0.4971499
109.61543 =	2.0398717
100.	2.
0.9122802 =	9.9601283 Diurnal motion.

	Diurnal motion of comet 1682.	Comet 1664.
Log. perih.	9.765877	0.011044
½	9.882939	5522
Perih. ſeſq.	9.648816	0.016566
	9.960128	9.960128
Log. d. mot.	0.311312	9.943562

Its diurnal motion therefore is 100, the number of parts that quadrant is divided into, divided by $109^{h}.14^{d}.46'.13''$, the time it is going it; that is, 0.912280, whoſe log. is 9.960128. Hence any other comet's diurnal motion is found; for velocity is reciprocally as the ſquare root of the diſtance from the ſun, and the ſine of the angle (and therefore in ſmall angles the angle itſelf) is reciprocally as the diſtance; the apparent motion therefore of a comet as ſeen from the ſun, is reciprocally as the cube of the ſquare root of its diſtance: the velocity being the root, the diſtance is the ſquare, and the apparent motion the cube. The diurnal motion therefore, of which I have juſt given two examples, is perih. ſeſq. : 1 :: 0.912280 : diurnal motion.

The log. of diurnal motion thus found, ſaves the four lines uſed in finding it every time the comet's place is computed: the log. of the time between the comet's perihelion and time ſought (reduced to decimals of a day, by table VII.) added to the log. of diurnal motion, gives the log. of mean motion, and if that is above 1.517428, its natural number is not wanted: find then in the parabolick table, N°. II. the article next below the mean motion ſought, and ſay, difference : remainder :: 300″ : proportional parts :: difference of log. of diſtance : its proportional parts. Required the angle and log. of diſtance, anſwering to 1.519782; this is above 45°. 15′; then 986:378 :: 300 : 115 :: 263 : 101; the angle therefore is 45°. 16′. 55″, and the log. of diſtance 0.069658. The next thing wanted is the comet's angle from the node: here, that we may always find it by addition, and ſave two lines in doing it by a ſingle proceſs, and not take it firſt from the perihelion, and thence from the node, I vary from Dr. Halley's method; for the article perih. poſt nodum is always the angle the comet moves, after paſſing its aſcending node till it comes to the perihelion, be it more or leſs than 180 degrees; and uſing always the angle the comet has moved ſince its

378	2.577		2.577
300	2.477	263	2.420
986	2.994		2.994
115 =	2.060	101 =	2.003

its laſt perihelion, (by taking the ſupplement to 360°, of the angle found by the parabolick table, if the place computed is before the comet's perihelion,) theſe two angles muſt always be added together, whether the comet is direct or retrograde, before or after its perihelion, and in whatever part of the orbit its node is; and rejecting 360° if neceſſary, if the angle is leſs than 180° the comet is in *north latitude*, if more, in *ſouth*. The tangent and ſine of this angle being uſed in the two next proportions, we muſt obſerve, that an angle, its ſupplement, and 180° more or leſs, have the ſame ſine and tangent, and that the angle reduced to the ecliptick, is always nearer 0, 180, or 360 degrees, than the angle from the node. So then R : coſ. of Incl. of the orbit : : tang. of angle from node : tang. of the angle on the ecliptick, which added to the place of the comet's node if direct, or ſubſtracted if retrograde, gives the *heliocentrick longitude*; as R : *s.* Incl. : : *s.* of angle from node : *s.* of *heliocentrick latitude.*

Again, the log. of the comet's perihelion diſtance, + log. of its increaſed diſtance as above found, + coſ. of heliocentrick latitude, gives the projection of the comet's place on the plain of the ecliptick, and the ſun's place and diſtance from the earth being found, in the triangle S C E, fig. 10, are given S C, S E, and C S E, therefore the leſſer ſide is to the greater, as R : tang. of an angle, and R : tang. of that angle — 45° : : tangent of half the ſum : tang. of half the difference of the two other angles; then $\frac{1}{2}$ the ſum + $\frac{1}{2}$ the difference being the greater, and $\frac{1}{2}$ ſum — $\frac{1}{2}$ difference the leſſer angle, the comet's *geocentrick longitude* is thence known. Laſtly, E C : S C, that is, ſine of angle at the ſun : ſine of angle at the earth : : tang. of heliocentrick latitude : tang. of *geocentrick.* Taking out natural numbers being troubleſome and liable to error, I avoid it as much as may be; for inſtance, when the ſine of the heliocentrick latitude is 9.852389, which is above 45°. 23′, its coſine and tangent are wanted, but not the angle itſelf; then difference of ſine is to difference of tangent, as remainder of ſine to remainder of tangent; 21 : 42 : : 18 : 36 for the tangent, which is therefore 10.005847, as the coſine is 9.846542. In like manner let 10.261606 be the tangent of an angle above 61°. 17′. 50″; then the tangent of 45° leſs, or above 16°. 17′. 50″ is thus found, 50 : 78 : : 27 : 42, the tangent then is 9.465972.

78	1.892
27	1.431
50	1.699
42	1.624

Caille's Comet of 1739.				
Log. diurn. mot.	0.217546	May	17^{d}.8^{h}.39'	
Time 20.0556	1.302236	Perih. June	6 . 9 . 59	
			20 . 1 . 20	
Log. mean mot.	1.519782		1 . 12	
Natural number				7.12
Angle	45°.16'.55"	378.577	577	52
Supplement	314 . 43 . 5	300.477	263.420	
Perih. poſt node	104 . 46 . 34	986.994	994	
		115.060	101.003	
Ang. from node	59 . 29 . 39			
Coſ. Inclination	9.750778	3^{s}.8°.17'.35" 23	0.006154 37 3	⊖'s diſt. a ⊙ 6194
T. ang. from node	10.229750			
Tangent of angle	9.980528			
on ecliptick	43°.42'.58"			
Sine of Inclinat.	9.917095			
S. ang. from node	9.935294			
S. helioc. lat.	9.852389	1739, 6^{s}.12°.13'.42" May 17. 4 . 15 . 1 . 38 8^{h} 19 . 43 39' 1 . 36	10 . 27 . 36 . 39 3 . 8 . 17 . 58 1 . 1 . 13 +	Sun's place 2 . 6 . 55 . 50
Helioc. lat.				
Long. ♍	13°.42'.16"			
Log. of perih.	9.828388			
Log. of diſtance	0.069658			
Coſ. helioc. lat.	9.846542			
Curtate diſtance	9.744588			
Earth from ſun	0.006194			
Tangent	10.261606	78	8^{s}. 6°.55'.50"	
Angle	61°.17'.50"	27	5 . 13 . 42 . 16	
		50	2 . 23 . 13 . 34	
T. of ang. — 45°	9.465972	42	3 . 6 . 46 . 26	
Tang. of ½ ſum	10.051465	½ ſum	48 . 23 . 13	
		½ diff.	18 . 13 . 14	
Tang. of ½ diff.	9.517437		66 . 36 . 27	
S. ang. at earth	9.701147		30 . 9 . 59	
Tang. helioc. lat.	10.005847			
			See fig. 10.	
S. ang. at ſun	9.996958			
Tang. geoc. lat.	9.710036		Place obſerved.	
Geocent. lat.	N. 27°.9'.10"		N. 27°.9'	
Long.	♋ 7 . 5 . 50		♋ 7 . 6	

Barker's Comet of Jan. 1742.				
	0.130344	Feb.	18^{d}. 8^{h}.32'	
20.7368	1.316742	Jan.	28 . 14 . 51	
			20 . 17 . 41	
	1.447086		16 . 48	
	27.9954			43.12
	39°.23'.34"	495.695	695	8 38
		300.477	226.354	1 09
	328 . 30 . 10	694.841	841	
		214.331	161.208	
	7 . 53 . 44			
	9.582340	3^{s}.8°.20'.37" 8	9.996519 11	⊖'s diſt. a ⊙ 530
	9.142021			
	8.724361			
	3°.2'.4"			
	9.965701			
	9.137884			
	9.103585	1742, 6^{s}.12°.26'.49" Feb. 18. 1 . 18 . 17 . 40 8^{h} 19 . 43 32' 1 . 19	8 . 1 . 5 . 31 3 . 8 . 20 . 45 1 . 1 . 42 . 52 +	Sun's place 11 . 11 . 9 . 8
	♎ 2°.7'.26"			
	9.886522			
	0.052367			
	9.996473			
	9.935362			
	9.996530			
	10.061168	33½	6^{s}. 2°. 7'.26"	
	49°.1'.10"	301	5 . 11 . 9 . 8	
			20 . 58 . 18	
	8.846994	42½	159 . 1 . 42	
	10.732633	238	79 . 30 . 51	
			20 . 48 . 0	
	9.579627	54	100 . 18 . 51	
	9.931756	167	58 . 42 . 51	
	9.107112			
		165	See fig. 11.	
	9.553769	55		
	9.485099		Place obſerved.	
	N. 16°.59'.30"		N. 16°.58'	
	♑ 12 . 26 . 20		♑ 12 . 24	

Beſides calculating a comet's place, the parabolick table may be uſed in drawing any *parabola*. For, firſt, the natural number of the log. of diſtance at any angle, is the diſtance of that point of the parabola from the focus, in parts of the focal length; thus any number of points may be ſet off, by the angle from the vertex, and diſtance from the focus. Thus the log. of diſtance at 42 degrees from the vertex is 0.059697; its natural number 1.14735, that point of the parabola therefore is diſtant from the focus about 1 $\frac{1}{7}$ of the focal length.

Secondly, One proceſs reduces this diſtance from the focus, to any other known meaſure: as let the focal length of a parabola be 3.6 inches; then a point 42 degrees of angle from the vertex is 4.1305 inches from the focus

Log. diſt.	0.059697
3.6	0.556302
	0.615999
Diſt. in inches	4.1305

Thirdly, The angle in a parabola, at a great diſtance from the vertex, alters very little; in that caſe therefore, the points may perhaps be better ſet off, by the diſtances from the focus and from the axis, that is, the ordinate; which is thus found, R : *s.* ang. from vertex : : diſt. from focus : ordinate. And if it be thought better, it may be done by the ordinate and abſciſſa, which is always one focal length leſs than the diſtance from the focus. Take for inſtance the ordinate, diſtance from focus, and abſciſſa at 170 degrees from the vertex, both in parts of the focal length and inches.

S. 170° —	9.239670		9.239670
Diſt. a foc.	2.119408	In.	2.119408
Focal length		3.6 =	0.556302
Ordinate	1.359078		1.915380
	22.8601	Inches	82.2962
Diſt. a foc.	131.6461		473.9254
Abſciſſa	130.6461		470.3254

Fourthly, But the beſt way to draw a comet's orbit round the ſun is, marking the points at ſome certain interval from each other, as ſuppoſe 4, 8, 12, *&c.* days motion from the perihelion; hereby the point the comet is in at any time may quickly be known. To find theſe points, multiply the comet's diurnal motion by the number of days; the angle in the table correſponding to that, is the angle it is from the perihelion; as the correſponding log. of diſtance + log. of perihelion diſtance, gives the diſtance from the ſun, in parts of the *magnus orbis*. Try the comet of 1682, 40 days from its perihelion.

Fifthly, When a comet whoſe perihelion diſtance is very ſmall, is a great way from the ſun, its angle from the perihelion alters very ſlowly; the points therefore, if thought better, may be laid out by the diſtances from the ſun and from the axis, as juſt now propoſed in the third uſe. Find then the angle diſtance and ordinate of the comet of 1680, at 120 days from its perihelion. Yet if when a comet is much further from the ſun than the earth is, its

Log. diur. mot.	0.311312
40 days	1.602060
	1.913372
Ang. from per.	82°. 9′
Log. diſt.	0.245413
Log. perih.	9.765877
	0.011290
Comet from ſun	1.0263
Log. diur. mot.	3.279469
120 days	2.079181
	5.358650
Angle	174°. 30′. 35″
Log. diſt.	2.639480
Log. perih.	7.787106
2.6705 =	0.426586
S. of angle	8.980807
	9.407393
Ordinate	0.2555

angle be not ſet off in the *magnus orbis*, but on a larger concentrick circle, it will I believe be as well done, by the angle from the perihelion and diſtance from the ſun.

In this manner the angle, diſtance and ordinate of the comet of 1680, and the angle and diſtance of that of 1682, are given for every fourth day from the perihelion, as far as they can be ſeen, in table VIII. Table IX. gives the length of the abſciſſa and ordinate of a parabola, in parts of the focal length, for every tenth degree, and oftener at laſt. And table X. gives the hourly motion of a comet, at different diſtances from the ſun, (which is as the ſquare root of its diſtance,) both in parts of the earth's mean diſtance, and in miles, ſuppoſing the earth 77,000,000 of miles from the ſun, that is the ſun's parallax 10 ½ ſeconds; and the times which comets of different perihelion diſtances take to go from their perihelion to their *latus rectum*; which are to one another as the ſquare root of the cube of their perihelion diſtance, as I mentioned above in page 18.

Sixthly, As to the uſe of the table in the parabolick motion of projectiles, ſee fig. 7. The abſciſſa P Q, which is the height they riſe, is always equal to S C — S P, that is one leſs than the diſtance from the focus, which is given by the table: the horizontal diſtance they fly, is twice the ordinate C Q: and Q T (= 2 P Q, that is twice the abſciſſa) is to C Q (the ordinate) as radius to cot. of Q C T, the angle of elevation.

Calculating a comet's place by a parabola, which is a very regular figure, has no proper difficulty in it; yet, being full 30 lines beſides the ſun's place, *&c.* is tedious; therefore an eaſy way to conſtruct a comet's place may be very uſeful, where only a general account of a comet's motion is wanted, though by no means ſufficient where nicety is required. See then fig. 9. On a ſheet of paſteboard draw a circle five or ten inches radius for the *magnus orbis*, the center of which is the ſun; and the real diſtance of the earth may be marked about the eighth degree of each ſine, a little without the circle from ♎ to ♈, and a little within it from ♈ to ♎; and divide the circle into ſigns and degrees. From the table of elements, N°. I. mark true, both as to angle and diſtance, the perihelion of the comet required: through the ſun draw the axis of the parabola, and by article 4. of the uſes of the parabolick table, (page 21) ſet off the ſeveral points of the orbit, where the comet is at every fourth day's interval, on on each ſide of its perihelion. But as comets do not move in the plain of the ecliptick, on the proper angle, draw through the ſun its line of nodes, and from the ſeveral points of the orbit, let fall perpendiculars upon it; on them mark a freſh row of points, whoſe diſtance from the line of nodes ſhall each be to their reſpective perpendiculars, as the coſine of the inclination of the comet's orbit is to radius. Theſe points, which for diſtinction I make little croſſes, form the curve of the projection of the comet's orbit on the plain of the ecliptick, which is always uſed in conſtructing a comet's place, and is, as Caille ſhews, art. 519 of his aſtronomy, itſelf alſo a parabola, yet has by no means the ſame focus or poſition of axis, as the orbit itſelf; as would more plainly appear, by drawing the comet of 1577. For better diſtinction, the parabola itſelf is a fine ſtroke; the figures are written on that ſide of the orbit which is fartheſt from the line of nodes, and conſequently from the projection of the orbit on the ecliptick; and the titles of the comets, are written the ſame way as the comet moves. Thus is the orbit of a comet made ready for uſe at any time, and its apparent place may be thus found:

Count the days from the comet's perihelion to the time required, and mark the point in the projection of the orbit, over which the comet then is; lay one edge of a parallel rule, from that point to the place of the earth at the ſame time, and the other edge paſſing through the ſun, will cut the *magnus orbis* in the apparent longitude of the comet. Again, draw two right lines, cutting each other in the angle of the comet's inclination; from their interſection ſet off in one of them the length of the perpendicular from the comet's curtate place to the line of nodes, and a perpendicular erected to the other is the tangent of the comet's apparent latitude, making the curtate diſtance of the comet from the earth the radius. Thus may firſt, the courſe of a known comet quickly be traced, and in what part of the heavens to expect firſt to ſee it, when it returns again, be found; for ſince the period of no comet is yet known exactly, and for the reaſons mentioned in page 5, they will not perhaps be always equal, we cannot fix the very month a comet will return in; and ſhould therefore know where to look, if it comes a little ſooner or later than is expected. Secondly, when a known comet returns, one obſervation will, with this ſcheme, ſhew its whole future courſe; for from the earth's place, at the time of obſervation, draw a line in the obſerved longitude of the comet, this cuts the projection of the comet's orbit in the place where it then was, whether the latitude agrees may be tried as above directed; and the day's motion marked on that curve, will ſhew where it will be at any other time. Thirdly, the periods of comets may perhaps be ſometimes found by this ſcheme, when the obſervations are too defective to calculate the orbit by. For inſtance, no comet ſeen in Auguſt in ♒ can be that of 1682, nor can one ſeen in June eaſily be that of 1680, which muſt be then cloſe to or beyond the ſun, but one ſeen in January between ♒ and ♊ may; it remains then to try, whether the latitude, motion, and other circumſtances agree with what might be expected of that comet, and as they agree or not, there is a probability of its being the ſame, or a proof that it is not.

I have choſen as an example of this method of conſtructing, the comet of 1682, which is ſhortly expected to return; and in twelve ſhort tables, N°. XI. ſuppoſing its perihelion any month in the year, ſhew what the apparent courſe of the comet would be, which are very different one from another; for as appears on view, from April to November it would move direct, be in ſome of the ſigns from ♈ counting forward to ♐, and chiefly in north latitude: between November and April it would be retrograde, between ♊ and ♍ counting backward, and be ſeen, diſappear, and be ſeen again: that if ſeen about the beginning of ſummer, being at or a little after its perihelion, it would make the beſt ſhew, and be ſeen the ſhorteſt time; but will make very little figure in winter. The two firſt articles in each table, are the place about which the comet might be firſt ſeen, if its perihelion ſhould prove that day which is ſet at the head of the table; for inſtance, if its next perihelion ſhould be Sept. 23, whether 1757 or 1758, then about Auguſt 14 it may begin to be ſeen, being in 24 degrees of ♊, with 7 or 8 degrees north latitude. Theſe tables ſhew in general how the comet would move, but in the middle of its courſe cannot be depended upon for a nicety; as a ſmall inaccuracy may occaſion great error, if the comet ſhould croſs the *magnus orbis* in its deſcent toward the ſun about the middle of October, or in its aſcent about the beginning of May, when it may move 40° in a day: ſo alſo if its perihelion ſhould be a week or fortnight different from what I have ſuppoſed, it may make a conſiderable variation in its track. The two known periods of this comet are indeed more different than one could ſuſpect; for the laſt was not 75 years, and an equal interval would make its next perihelion July 25, 1757; but if this revolution ſhould be as long as the former was, that is above 76 years, it cannot be till Oct. 25, 1758. Yet as the reſt of the elements agree ſo well all the three times, we cannot but ſuppoſe them to be the ſame; and as I can ſee no principle in nature to make its period alternately longer and ſhorter, I can refer the different intervals to nothing but thoſe irregularities to which comet's orbits are liable. Yet on this account I have in another table, N°. XII. ſhewn in what part of the heavens the comet may be expected to begin to be ſeen, in any month of the year; as ſuppoſe it firſt gets near enough to be ſeen the beginning of July, we find that its apparent motion will be then direct, its place the beginning of ♊, the latitude north and increaſing, and that it will come to its perihelion about a month afterwards.

Thus I have treated of the motion of comets, the gradual diſcovery of it, the way to find their real path, and to trace it either with reſpect to the ſun or the earth; by which means we may hope to know the times of their revolutions better hereafter. But of their nature and uſes I have not ventured to ſpeak, chuſing rather to leave ſuch points as are at preſent ſo little, I may almoſt ſay not at all known, to thoſe, if any ſuch ſhall hereafter be, who by greater light afforded them ſhall be enabled to ſearch deeper into thoſe hidden works of God. The works of an infinite Creator are without number; knowledge, though ſo greatly increaſed of late, has by no means compleated the ſearch into the works of nature; freſh ſubjects of admiration and praiſe will ſtill appear, as long as God ſees fit to continue men upon earth, I nor can ſuppoſe that increaſe of knowledge will then ceaſe. The farther we ſearch into the works of God, the more inſtances of power, wiſdom, and goodneſs we continually meet with. *There are yet hid greater things than theſe be, for we have ſeen but a few of his works*, was a wiſe remark of the ſon of Syrach, when contemplating and praiſing God for his many and wonderful works; and the ſame acknowledgment we may ſtill make. For to begin near home, multitudes of things, both inanimate, plants, and animals familiar to us, were unknown in former times; and great proofs of wiſdom and goodneſs appear in their ſeveral properties, the plentiful proviſion made for the well-being and ſupport of all, and the fitneſs of every thing to its proper end, yet new diſcoveries are continually made. But how greatly does our proſpect enlarge, when we look on this world only as one ſmall part of the works of our Creator, and on every other planet and comet as a ſcene of as many and ſtill various wonders! nor can we regard the moſt diſtant bodies otherwiſe than as multiplied inſtances of the ſame power and wiſdom: how greatly then, conſidered in this light, do *the heavens declare the glory of God!*

> Theſe are thy glorious works, Parent of good
> Almighty; thine this univerſal frame.
> Thus wondrous fair, thyſelf how wondrous then!
>
> MILTON.

To come then to the preſent point, *he hath made all things for their uſes:* comets, which are much more numerous than the planets, are doubtleſs deſigned for as wiſe ends, yet being ſo very different from them, both in appearance and motion, ſerve probably to quite different purpoſes; and poſſibly we who inhabit a planet, can have no more idea of the deſign of a comet, than one who never knew any thing of hearing could have of the uſe of an ear; he might juſtly conclude, that ſo artful a machine was not placed in the head for nothing, and ſo may we of comets, but the real intention we could in neither caſe find out. The appearance of a comet's tail is very ſurprizing, and various have been the gueſſes at the cauſe of it; Sir Iſaac Newton's I think as plauſible as any; yet it is much eaſier to make objections againſt any of the opinions, than to give a better.

I mean not hereby to diſcourage inquiry into the nature and uſes of comets; no, there is ſcarce any employment better becomes a creature, than ſearching into any of the works of the great Creator. Yet let us not ſtop at the diſcovery of the works, but be thereby led to acknowledge the workmaſter. *If we are aſtoniſhed at their power and virtue, let us underſtand how much mightier he is that made them.* If we obſerve the uniformity of that univerſal principle of gravity, let us conſider the infiniteneſs of that one God, who in ſo wonderful yet hidden a manner, reſtrains the amazing ſwiftneſs of ſuch vaſt bodies, by a power which yet does not hinder the leaſt creature of its proper motion. When we ſee that the ſame power which guides thoſe numberleſs, vaſt, and immenſely diſtant bodies, is yet not unmindful of the moſt minute, we muſt remember, that he who regards the good of the merely ſenſitive beings, will much more obſerve in every action, how we employ that reaſon he has entruſted us with: that nothing can be concealed from him who made all things; that one conſtantly employed in doing good cannot be pleaſed with trifling, nor the wiſe with folly; that the holy cannot but hate wickedneſs, the juſt abhor injuſtice, and the merciful deteſt cruelty; and that the all-powerful maker and ruler of the world, muſt needs in due time diſtinguiſh between *him that ſerveth God, and him that ſerveth him not:* and above all, that no ſwiftneſs can eſcape him, who threw the aſtoniſhingly ſwift planets and comets, and guides the ſtill much more impetuous light; no diſtance avoid him, who is not confined to the entire ſolar ſyſtem, nor to thoſe multitudes of others, of which we can but juſt diſcover the central bright point; that no craft can deceive him from whom all the wiſdom in the world is derived; and no power reſiſt him, at whoſe rebuke the earth trembles, and the very foundations of the hills ſhake; nor can any greatneſs protect from him, who *made the ſmall as well as the great, and careth for all alike*, and by whoſe ſtroke the greateſt monarch is reduced to the ſame mouldering duſt as the loweſt of his ſubjects.

Again, if we admire the wiſdom of God as ſhewn forth in his works, wonder at thoſe inconceivably vaſt regions of light, the nebulous ſtars; the ſurprizing ſingularity of ſaturn's ring; and the entire diverſity of the comets from the planets; whoſe uſes are all too far beyond our ken to diſcover: and to come more within our own view, if we remark that wonderful inſtinct, by which *the ſwallow knoweth his appointed time*; the careful ſorting of proper fruits and creatures, to all the ſo various climates on our own earth; and the no leſs ſurprizing diverſity of inhabitants, allotted to ſuch different mediums as air, water, earth, and ſtill harder ſubſtances; and the connecting links as it were in the chain of beings, which are between plants and animals, air and water creatures, beaſts and birds, *&c.* let none then pretend to be wiſer than God, or above being taught by him; for as we cannot but know it is our intereſt to pleaſe him in whoſe power we entirely are, ſo it is as certain, that none knows his will ſo well as he does himſelf: nor can there well be a greater folly, than to prefer the uncertain deductions of frail, created reaſon, (which 4 or 5000 years experience ſhewed can never form a uniform ſyſtem of morality; though it could not refuſe its aſſent, when chriſtianity had explained it;) to the clear diſcoveries, I do not ſay of unauthorized human gloſſes, but of the genuine revelations from perfect, ſelf-exiſtent wiſdom. Two extreams are here to be avoided; either deſpiſing that noble faculty, and glory of man, *reaſon*, and refuſing to ſee any thing, becauſe we cannot ſee every thing; this is ſlighting the gift of God, hiding our talent in the earth, and tends to *enthuſiaſm:* or on the other hand ſo glorying in it, as to forget it is the gift of God, and preferring a candle to the light of the ſun when offered; this is deſpiſing God himſelf, refuſing to ſubmit to his governance, and tends to *atheiſm.* Laſtly, if on a review of the whole we may juſtly ſay, *the works of the Lord are great, ſought out of all them that have pleaſure therein*; it will appear from contemplating them, that *there is one wiſe and greatly to be feared, the Lord ſitting on his throne:* and as it is plain, that *the Lord is king, be the people never ſo impatient,* ſo it is as true, when we conſider his extenſive wiſdom and goodneſs, that *the earth may be glad thereof.* When therefore, reflecting on the power, wiſdom, and goodneſs of God, as ſhining forth in his mighty works, *you glorify the Lord, exalt him as much as you can, for even yet he will far exceed; and when you exalt him put forth all your ſtrength, and be not weary, for you can never go far enough.*

TABLE I. *The Elements of the Orbits of*

Time of Perihelion.						Perih. Dist.	Log. of it.	L.D.Mo.	Place of Perih.				Per.p.Nod.		
1264	July	6ᵈ	8ʰ	′	″	44500	9.648360	0.487588	♑ˢ	21°	′	″	122°	′	″
1337	June	2	6	25		40666	9.609236	0 546274	♉	7	59	0	46	22	0
1472	Feb.	28	22	23		54273	9.734584	0.358252	♉	15	33	30	236	12	50
1531	Aug.	24	21	18	30	56700	9.753583	0.329754	♒	1	39	0	107	46	0
1532	Oct.	19	22	12		50910	9.706803	0.399924	♋	21	7	0	30	40	0
1533	June	16	19	30	0	20280	9.307068	0.999526	♌	27	16	0	338	28	0
1556	April	21	20	3		46390	9.666424	0.460492	♑	8	50	0	103	8	0
1577	Oct.	26	18	45		18342	9.263447	1.064958	♌	9	22	0	256	30	0
1580	Nov.	28	15	0		59628	9.775450	0.296953	♋	19	5	50	90	8	30
1585	Sept.	27	19	20		1.09358	0.038850	9.901853	♈	8	51	0	331	8	30
1590	Jan.	29	3	45		57661	9.760882	0.318805	♏	6	54	30	308	36	10
1593	July	8	13	38		08911	8.949940	1.535218	♍	26	19	0	12	4	45
1596	July	31	19	55		51293	9.710058	0.395041	♏	18	16	0	83	56	30
1607	Oct.	16	3	50		58680	9.768490	0.307393	♒	2	16	0	108	5	0
1618	Oct.	29	12	23		37975	9.579498	0.590881	♈	2	14	0	286	13	0
1652	Nov.	2	15	40		84750	9.928140	0.067918	♈	28	18	40	300	8	40
1661	Jan.	16	23	41		44851	9.651772	0.482470	♋	25	58	40	33	28	10
1664	Nov	24	11	52		1.02575½	0.011044	9.943562	♌	10	41	25	310	32	35
1665	April	14	5	15	30	10649	9.027309	1.419164	♊	11	54	30	156	7	30
1672	Feb.	20	8	37		69739	9.843476	0 194914	♉	16	59	30	109	29	0
1677	April	26	0	37	30	28059	9.448072	0.788020	♌	17	37	5	99	12	5
1678	Aug.	16	14	3	0	1.23802	0.092727	9.821037	♒	27	46	0	166	6	0
1680	Dec.	8	0	6		00612½	7.787106	3 279469	♐	22	39	30	350	37	30
1682	Sept.	4	7	39		58328	9.765877	0.311312	♒	2	52	45	108	23	45
1683	July	3	2	50		56020	9.748343	0.337614	♊	25	29	30	87	53	30
1684	May	29	10	16		96015	9.982339	9.986620	♏	28	52	0	330	37	0
1686	Sept.	6	14	33		32500	9.511883	0.692304	♊	17	0	30	86	25	50
1698	Oct.	8	16	57		69129	9.839660	0.200638	♑	0	51	15	356	53	0
1699	Jan.	3	8	22		74400	9.871570	0.152773	♏	2	31	6	289	14	29
1702	Mar.	2	14	12		64590	9.810165	0.244881	♌	18	41	3	309	15	48
1706	Jan.	19	4	22		42581	9.629218	0.516301	♊	12	29	10	59	17	30
		19	4	56	0	42686½	9.630291	0.514692		12	36	25	59	25	2
1707	Nov.	30	23	29		85974	9.934368	0.058576	♊	19	54	56	27	8	21
		30	23	43	6	85904	9.934013	0.059109		19	58	9	27	7	40
1718	Jan.	4	1	14	55	1.02565	0.010999	9.943629	♌	1	26	36	6	28	50
		3	23	38		1.02655	0 011380	9.943058		1	30	0	7	13	0
		4	7	48		1.02743	0.011753	9.942499		1	3	40	7	17	20
1723	Sept.	16	16	10		99865	9.999414	9.961007	♉	12	52	20	331	23	40
1729	June	14	10	56		4.26140	0.629552	9.015800	♒	22	40	0	12	7	23
		12	6	35	41	4.06980	0.609573	9.045769			16	53	11	41	38
1737	Jan.	19	8	20		22282	9.347960	0.938188	♒	25	55	0	99	33	0
1739	June	6	9	59		67358	9.828388	0.217546	♋	12	38	40	104	46	34
		9	9	14		69614	9.842697	0.196083		5	11		110	7	
1742	Jan.	28	4	38		76568	9.884049	0.134055	♏	7	35	13	328	3	16
		28	4	20	50	76555½	9.883693	0.134589		7	33	44	328	1	1
		28	14	51		77005½	9.886523	0.130344		6	39	20	328	30	10
1742	Dec.	30	20	25		83501	9.921690	0.077593	♋	2	41	45	14	20	30
		30	21	15	16	83811½	9.923304	0.075172		2	58	4	24	47	16
1743	Sept.	9	21	16	18	52157	9.717313	0.384159	♐	6	33	52	118	42	33
1744	Feb.	19	8	12		22206	9.346472	0.940420	♎	17	12	55	151	27	55
		19	8	3		22250	9.347325	0.939141		17	10	0	151	23	49
1747	Feb.	20	7	10		2.1[illegible]851	0.342128	9.446936	♑	7	2	0	230	16	50
		17	11	44	38	2.29388	0.360571	9.419272		10	5	41	226	52	46
1748	April	17	19	25		84066½	9.924624	0.073192	♏	5	0	50	17	51	25
1748	June	7	1	24	15	65525½	9.816410	0.235513	♑	6	9	24	241	29	41

Aſcending Node.				Inclination			Coſ. of it.	Sine of it.		Calculator.
♍^{s}	19°	′	″	36°	30′	″	9 905179	9.774388	Direct	Dunthorne.
♊	24	21	0	32	11	0	9.927549	9.726426	Retrog.	Halley.
♑	11	46	20	5	20	0	9.998116	8.968249	Retrog.	Halley.
♉	19	25	0	17	56	0	9.978370	9.488424	Retrog.	Halley.
♊	20	27	0	32	36	0	9.925545	9.731404	Direct	Halley.
♌	5	44	0	35	49	0	9.908964	9.767300	Retrog.	Downes. (See p. 13.)
♍	25	42	0	32	6	30	9.927906	9.725521	Direct	Halley.
♈	25	52	0	74	32	45	9.425644	9 984007	Retrog.	Halley.
♈	18	57	20	64	40	0	9.631326	9.956089	Direct	Halley.
♉	7	42	30	6	4	0	9.997561	9 024016	Direct	Halley.
♍	15	30	40	29	40	40	9.938932	9.694712	Retrog.	Halley.
♍	14	14	15	87	58	0	8.549995	9.999726	Direct	C.
♒	12	12	30	55	12	0	9.756418	9.914422	Retrog.	Halley.
♉	20	21	0	17	2	0	9.980519	9.466761	Retrog.	Halley.
♊	16	1	0	37	34	0	9.899078	9.785105	Direct	Halley.
♊	28	10	0	79	28	0	9.261994	9.992619	Direct	Halley.
♊	22	30	30	32	35	50	9.925559	9.731371	Direct	Halley.
♊	21	14	0	21	18	30	9.969247	9.560369	Retrog.	Halley.
♏	18	2	0	76	5	0	9.381134	9.987061	Retrog.	Halley.
♑	27	30	30	83	22	10	9.062457	9.997085	Direct	Halley.
♏	26	49	10	79	3	15	9.278481	9.992026	Retrog.	Halley.
♍	11	40	0	3	4	20	9.999375	8.729122	Direct	Downes.
♑	2	2	0	60	56	0	9.686482	9.941539	Direct	Halley.
♉	21	16	30	17	56	0	9.978370	9.488424	Retrog.	Halley.
♍	23	23	0	83	11	0	9 074424	9.996919	Retrog.	Halley.
♐	28	15	0	65	48	40	9.612515	9.960090	Direct	Halley.
♓	20	34	40	31	21	40	9.931409	9.716363	Direct	Halley.
♐	27	44	15	11	46	0	9.990777	9.309474	Retrog.	Halley.
♌	21	45	35	69	20	0	9.547689	9.971113	Retrog.	Caille. (See p. 13.)
♎	9	25	15	4	30	0	9.998659	8.894643	Direct	Caille.
♈	13	11	40	55	14	10	9.756024	9.914612	Direct	C.
	13	11	23	55	14	5	9.756039	9 914605		Struijck.
♉	22	46	35	88	36	0	8.387962	9.999870	Direct	C.
	22	50	29	88	37	40	8 379260	9.999875		Struijck.
♌	7	55	20	31	12	53	9.932083	9.714536	Retrog.	Downes.
	8	43	0	30	20	0	9.936062	9.703317		C. (See p 13.)
	8	21	0	30	48	30	9.933940	9.709398		Whiſton.
♈	14	16	0	49	59	0	9.808218	9 884148	Retrog.	Bradley.
♒	10	32	37	76	58	4	9.353126	9.988667	Direct	C.
	10	35	15	77	1	58	9.351010	9.988781		Downes.
♏	16	22	0	18	20	45	9.977346	9.497968	Direct	Bradley.
♎	27	25	14	55	42	44	9.750778	9.917095	Retrog.	Caille. (See p. 13.)
	25	18		53	25		9.775240	9.904711		Zanotti.
♎	5	38	29	66	59	14	9.592106	9.963985	Retrog.	C.
	5	34	45	67	4	11	9.590631	9.964250		Struijck.
	5	9	30	67	31	40	9.582340	9.965701		Barker. (See p. 13.)
♊	18	21	15	2	19	33	9 999642	8.608337	Direct	C.
	8	10	48	2	15	50	9.999661	8.596619		Struijck.
♈	5	16	25	45	48	21	9.843290	9.855508	Retrog.	Klinkenberg.
♉	15	45	20	47	8	36	9.832616	9 865138	Direct	Betts.
	15	46	11	47	5	18	9.833064	9.864751		C.
♌	27	18	50	79	6	20	9.276462	9.992101	Retrog.	C.
	26	58	27	77	56	55	9.319707	9.990321		Chezeaux.
♏	22	52	15	85	27	0	8.899432	9.998629	Retrog.	Maraldi.
♉	4	39	43	56	59	3	9.736293	9.923513	Direct	Struijck.

TABLE II. *A general Table of the Parabola.*

Angle from Perihelion.		Mean Mot.	Diff.	Log. Dist.	Diff.	Angle.		Mean Mot.	Diff.	Log. Dist.	Diff.
°	′					°	′				
0	5	0.0545	—545	0.000000	— 0	4	35	3.0030	—547	0.000695	—25
	10	0.1091	546	0.000001	1		40	3.0577	547	0.000720	25
	15	0.1636	545	0.000002	1		45	3.1124	547	0.000746	26
	20	0.2182	546	0.000004	2		50	3.1672	548	0.000773	27
	25	0.2727	545	0.000006	2		55	3.2219	547	0.000800	27
	30	0.3272	545	0.000008	2	5	0	3.2766	547	0.000827	27
	35	0.3818	—546	0.000011	—3		5	3.3314	—548	0.000855	—28
	40	0.4363	545	0.000015	4		10	3.3862	548	0.000883	28
	45	0.4909	546	0.000019	4		15	3.4409	547	0.000912	29
	50	0.5454	545	0.000023	4		20	3.4957	548	0.000941	29
	55	0.6000	546	0.000028	5		25	3.5505	548	0.000971	30
1	0	0.6545	545	0.000033	5		30	3.6053	548	0.001001	30
	5	0.7091	—546	0.000039	— 6		35	3.6601	—548	0.001031	—30
	10	0.7636	545	0.000045	6		40	3.7149	548	0.001062	31
	15	0.8182	546	0.000052	7		45	3.7697	548	0.001094	32
	20	0.8727	545	0.000059	7		50	3.8245	548	0.001126	32
	25	0.9273	546	0.000066	7		55	3.8793	548	0.001158	32
	30	0.9819	546	0.000074	8	6	0	3.9342	549	0.001191	33
	35	1.0364	—545	0.000083	— 9		5	3.9890	—548	0.001224	—33
	40	1.0910	546	0.000092	9		10	4.0439	549	0.001258	34
	45	1.1456	546	0.000101	9		15	4.0988	549	0.001293	35
	50	1.2001	545	0.000111	10		20	4.1536	548	0.001327	34
	55	1.2547	546	0.000121	10		25	4.2085	549	0.001362	35
2	0	1.3093	546	0.000132	11		30	4.2634	549	0.001398	36
	5	1.3638	—545	0.000144	—12		35	4.3183	—549	0.001434	—36
	10	1.4184	546	0.000155	11		40	4.3732	549	0.001471	37
	15	1.4730	546	0.000167	12		45	4.4281	549	0.001508	37
	20	1.5276	546	0.000180	13		50	4.4830	549	0.001545	37
	25	1.5822	546	0.000193	13		55	4.5380	550	0.001583	38
	30	1.6368	546	0.000207	14	7	0	4.5929	549	0.001622	39
	35	1.6914	—546	0.000221	—14		5	4.6479	—550	0.001661	—39
	40	1.7460	546	0.000235	14		10	4.7028	549	0.001700	39
	45	1.8006	546	0.000250	15		15	4.7578	550	0.001740	40
	50	1.8552	546	0.000266	16		20	4.8128	550	0.001780	40
	55	1.9098	546	0.000281	15		25	4.8678	550	0.001821	41
3	0	1.9644	546	0.000298	17		30	4.9228	550	0.001862	41
	5	2.0190	—546	0.000314	—16		35	4.9778	—550	0.001903	—41
	10	2.0736	546	0.000332	18		40	5.0328	550	0.001945	42
	15	2.1283	547	0.000349	17		45	5.0879	551	0.001988	43
	20	2.1829	546	0.000368	19		50	5.1429	550	0.002031	43
	25	2.2375	546	0.000386	18		55	5.1980	551	0.002074	43
	30	2.2922	547	0.000405	19	8	0	5.2531	551	0.002118	44
	35	2.3468	—546	0.000425	—20		5	5.3081	—550	0.002163	—45
	40	2.4015	547	0.000445	20		10	5.3632	551	0.002208	45
	45	2.4561	546	0.000465	20		15	5.4183	551	0.002253	45
	50	2.5108	547	0.000486	21		20	5.4734	551	0.002299	46
	55	2.5654	546	0.000507	21		25	5.5286	552	0.002345	46
4	0	2.6201	547	0.000529	22		30	5.5837	551	0.002392	47
	5	2.6748	—547	0.000552	—23		35	5.6389	—552	0.002439	—47
	10	2.7295	547	0.000574	22		40	5.6940	551	0.002487	48
	15	2.7842	547	0.000597	23		45	5.7492	552	0.002535	48
	20	2.8389	547	0.000621	24		50	5.8044	552	0.002583	48
	25	2.8936	547	0.000645	24		55	5.8596	552	0.002632	49
	30	2.9483	547	0.000670	25	9	0	5.9148	552	0.002682	50
			—547		—25				—552		—50

Angle.		Mean Mot.	Diff.	Log. Dist.	Diff.
°	′				
9	5	5.9[illegible]00	—552	0.002732	—50
	10	6.0253	553	0.002782	50
	15	6.0805	552	0.002833	51
	20	6.1358	553	0.002884	51
	25	6.1911	553	0.002936	52
	30	6.2464	553	0.002988	52
	35	6.3017	—553	0.003041	—53
	40	6.3570	553	0.003094	53
	45	6.4123	553	0.003148	54
	50	6.4677	554	0.003202	54
	55	6.5230	553	0.003257	55
10	0	6.5784	554	0.003312	55
	5	6.6338	—554	0.003367	—55
	10	6.6892	554	0.003423	56
	15	6.7446	554	0.003479	56
	20	6.8000	554	0.003536	57
	25	6.8555	555	0.003594	58
	30	6.9109	554	0.003652	58
	35	6.9664	—555	0.003710	—58
	40	7.0219	555	0.003769	59
	45	7.0774	555	0.003828	59
	50	7.1329	555	0.003887	59
	55	7.1885	556	0.003947	60
11	0	7.2440	555	0.004008	61
	5	7.2996	—556	0.004069	—61
	10	7.3551	555	0.004131	62
	15	7.4107	556	0.004193	62
	20	7.4663	556	0.004255	62
	25	7.5220	557	0.004318	63
	30	7.5776	556	0.004381	63
	35	7.6333	—557	0.004445	—64
	40	7.6890	557	0.004509	64
	45	7.7447	557	0.004574	65
	50	7.8004	557	0.004639	65
	55	7.8561	557	0.004705	66
12	0	7.9118	557	0.004771	66
	5	7.9676	—558	0.004838	—67
	10	8.0234	558	0.004905	67
	15	8.0792	558	0.004973	68
	20	8.1350	558	0.005041	68
	25	8.1908	558	0.005109	68
	30	8.2467	559	0.005178	69
	35	8.3025	—558	0.005247	—69
	40	8.3584	559	0.005317	70
	45	8.4143	559	0.005388	71
	50	8.4702	559	0.005458	70
	55	8.5262	560	0.005530	72
13	0	8.5822	560	0.005602	72
	5	8.6381	—559	0.005674	—72
	10	8.6941	560	0.005746	72
	15	8.7501	560	0.005819	73
	20	8.8062	561	0.005893	74
	25	8.8622	560	0.005967	74
	30	8.9183	561	0.006042	75
			—561		—75

Angle.		Mean Mot.	Diff.	Log. Dist.	Diff.
°	′				
13	35	8.9744	—561	0.006117	—75
	40	9.0305	561	0.006192	75
	45	9.0866	561	0.006268	76
	50	9.1428	562	0.006344	76
	55	9.1989	561	0.006421	77
14	0	9.2551	5[illegible]2	0.006498	77
	5	9.3113	—562	0.006576	—78
	10	9.3676	563	0.006655	79
	15	9.4238	562	0.006733	78
	20	9.4801	563	0.006813	80
	25	9.5364	563	0.006892	79
	30	9.5927	563	0.006972	80
	35	9.6490	—563	0.007053	—81
	40	9.7054	564	0.007134	81
	45	9.7617	563	0.007216	82
	50	9.8181	564	0.007298	82
	55	9.8745	564	0.007380	82
15	0	9.9310	565	0.007463	83
	5	9.9874	—564	0.007546	—83
	10	10.0439	565	0.007630	84
	15	10.1004	565	0.007714	84
	20	10.1569	565	0.007799	85
	25	10.2135	566	0.007884	85
	30	10.2701	566	0.007970	86
	35	10.3267	—566	0.008056	—86
	40	10.3833	566	0.008143	87
	45	10.4399	566	0.008230	87
	50	10.4966	567	0.008318	88
	55	10.5533	567	0.008406	88
16	0	10.6100	567	0.008494	88
	5	10.6667	—567	0.008583	—89
	10	10.7234	567	0.008673	90
	15	10.7802	568	0.008763	90
	20	10.8370	568	0.008853	90
	25	10.8938	568	0.008944	91
	30	10.9507	569	0.009036	92
	35	11.0076	—569	0.009127	—91
	40	11.0645	569	0.009220	93
	45	11.1214	569	0.009312	92
	50	11.1783	569	0.009406	94
	55	11.2353	570	0.009499	93
17	0	11.2923	570	0.009593	94
	5	11.3493	—570	0.009688	—95
	10	11.4063	570	0.009783	95
	15	11.4634	571	0.009879	96
	20	11.5205	571	0.009975	96
	25	11.5776	571	0.010071	96
	30	11.6348	572	0.010168	97
	35	11.6919	—571	0.010266	—98
	40	11.7491	572	0.010364	98
	45	11.8063	572	0.010462	98
	50	11.8636	573	0.010561	99
	55	11.9209	573	0.010660	99
18	0	11.9782	573	0.010760	100
			—573		—100

Angle	Mean Mot.	Diff.	Log. Dist.	Diff.	Angle.	Mean Mot.	Diff.	Log. Dist.	Diff.
° ′		—573		—100	° ′		—589		—126
18 5	12.0355	573	0.010860	101	22 35	15.1741	590	0.016978	126
10	12.0928	574	0.010961	101	40	15.2331	591	0.017104	127
15	12.1502	574	0.011062	102	45	15.2922	590	0.017231	128
20	12.2076	574	0.011164	102	50	15.3512	591	0.017359	127
25	12.2650	575	0.011266	103	55	15.4103	592	0.017486	129
30	12.3225	—575	0.011369	—103	23 0	15.4695	—591	0.017615	—128
35	12.3800	575	0.011472	104	5	15.5286	592	0.017743	130
40	12.4375	576	0.011576	104	10	15.5878	593	0.017873	129
45	12.4951	575	0.011680	104	15	15.6471	592	0.018002	130
50	12.5526	576	0.011784	105	20	15.7063	594	0.018132	131
55	12.6102	577	0.011889	106	25	15.7657	593	0.018263	131
19 0	12.6679	—576	0.011995	—106	30	15.8250	—594	0.018394	—132
5	12.7255	577	0.012101	106	35	15.8844	594	0.018526	132
10	12.7832	577	0.012207	107	40	15.9438	594	0.018658	133
15	12.8409	577	0.012314	107	45	16.0032	595	0.018791	133
20	12.8986	578	0.012421	108	50	16.0627	596	0.018924	133
25	12.9564	578	0.012529	108	55	16.1223	595	0.019057	134
30	13.0142	—578	0.012637	—109	24 0	16.1818	—596	0.019191	—135
35	13.0720	579	0.012746	109	5	16.2414	597	0.019326	135
40	13.1299	579	0.012855	110	10	16.3011	596	0.019461	135
45	13.1878	579	0.012965	110	15	16.3607	597	0.019596	136
50	13.2457	579	0.013075	111	20	16.4204	598	0.019732	137
55	13.3036	580	0.013186	111	25	16.4802	598	0.019869	136
20 0	13.3616	—580	0.013297	—112	30	16.5400	—598	0.020005	—138
5	13.4196	580	0.013409	112	35	16.5998	599	0.020143	138
10	13.4776	581	0.013521	112	40	16.6597	599	0.020281	138
15	13.5357	581	0.013633	113	45	16.7196	599	0.020419	139
20	13.5938	581	0.013746	114	50	16.7795	600	0.020558	139
25	13.6519	581	0.013860	114	55	16.8395	600	0.020697	140
30	13.7100	—582	0.013974	—114	25 0	16.8995	—601	0.020837	—140
35	13.7682	582	0.014088	115	5	16.9596	600	0.020977	141
40	13.8264	583	0.014203	116	10	17.0196	602	0.021118	141
45	13.8847	583	0.014319	116	15	17.0798	602	0.021259	142
50	13.9430	583	0.014435	116	20	17.1400	602	0.021401	142
55	14.0013	583	0.014551	117	25	17.2002	602	0.021543	143
21 0	14.0596	—584	0.014668	—117	30	17.2604	—603	0.021686	—143
5	14.1180	584	0.014785	118	35	17.3207	603	0.021829	144
10	14.1764	584	0.014903	118	40	17.3810	604	0.021973	144
15	14.2348	585	0.015021	119	45	17.4414	604	0.022117	144
20	14.2933	585	0.015140	119	50	17.5018	605	0.022261	146
25	14.3518	585	0.015259	120	55	17.5623	605	0.022407	145
30	14.4103	—585	0.015379	—120	26 0	17.6228	—605	0.022552	—146
35	14.4688	586	0.015499	121	5	17.6833	606	0.022698	147
40	14.5274	587	0.015620	121	10	17.7439	606	0.022845	147
45	14.5861	586	0.015741	121	15	17.8045	606	0.022992	147
50	14.6447	587	0.015862	122	20	17.8651	607	0.023139	148
55	14.7034	587	0.015984	123	25	17.9258	607	0.023287	149
22 0	14.7621	—588	0.016107	—123	30	17.9865	—608	0.023436	—149
5	14.8209	588	0.016230	123	35	18.0473	608	0.023585	149
10	14.8797	588	0.016353	124	40	18.1081	609	0.023734	150
15	14.9385	589	0.016477	125	45	18.1690	609	0.023884	151
20	14.9974	589	0,016602	125	50	18.2299	610	0.024035	151
25	15.0563	589	0.016727	125	55	18.2909	610	0.024186	151
30	15.1152	—589	0.016852	—126	27 0	18.3519	—610	0.024337	—152

Angle.	Mean Mot.	Diff.	Log. Dist.	Diff.	Angle.	Mean Mot.	Diff.	Log. Dist.	Diff.
° ′		—610		—152	° ′		—636		—178
27 5	18.4129	611	0.024489	152	31 35	21.7766	636	0.033417	179
10	18.4740	611	0.024641	153	40	21.8402	637	0.033596	180
15	18.5351	611	0.024794	153	45	21.9039	638	0.033776	179
20	18.5962	612	0.024947	154	50	21.9677	638	0.033955	181
25	18.6574	613	0.025101	155	55	22.0315	638	0.034136	181
30	18.7187	—613	0.025256	—154	32 0	22.0953	—639	0.034317	—181
35	18.7800	613	0.025410	156	5	22.1592	640	0.034498	182
40	18.8413	614	0.025566	156	10	22.2232	640	0.034680	182
45	18.9027	614	0.025722	156	15	22.2872	641	0.034862	183
50	18.9641	615	0.025878	157	20	22.3513	641	0.035045	184
55	19.0256	615	0.026035	157	25	22.4154	642	0.035229	183
28 0	19.0871	—615	0.026192	—158	30	22.4796	—642	0.035412	—185
5	19.1486	616	0.026350	158	35	22.5438	643	0.035597	185
10	19.2102	617	0.026508	158	40	22.6081	643	0.035782	185
15	19.2719	617	0.026666	160	45	22.6724	644	0.035967	186
20	19.3336	617	0.026826	159	50	22.7368	645	0.036153	186
25	19.3953	618	0.026985	160	55	22.8013	645	0.036339	187
30	19.4571	—618	0.027145	—161	33 0	22.8658	—645	0.036526	—187
35	19.5189	619	0.027306	161	5	22.9303	646	0.036713	188
40	19.5808	619	0.027467	162	10	22.9949	647	0.036901	189
45	19.6427	620	0.027629	162	15	23.0596	647	0.037090	188
50	19.7047	620	0.027791	163	20	23.1243	648	0.037278	190
55	19.7667	621	0.027954	163	25	23.1891	649	0.037468	190
29 0	19.8288	—621	0.028117	—163	30	23.2540	—649	0.037658	—190
5	19.8909	621	0.028280	164	35	23.3189	649	0.037848	191
10	19.9530	622	0.028444	165	40	23.3838	650	0.038039	191
15	20.0152	622	0.028609	165	45	23.4488	651	0.038230	192
20	20.0774	623	0.028774	166	50	23.5139	651	0.038422	193
25	20.1397	624	0.028940	166	55	23.5790	652	0.038615	192
30	20.2021	—624	0.029106	—166	34 0	23.6442	—653	0.038807	—194
35	20.2645	624	0.029272	167	5	23.7095	653	0.039001	194
40	20.3269	625	0.029439	168	10	23.7748	653	0.039195	194
45	20.3894	625	0.029607	168	15	23.8401	654	0.039389	195
50	20.4519	626	0.029775	168	20	23.9055	655	0.039584	195
55	20.5145	626	0.029943	169	25	23.9710	656	0.039779	196
30 0	20.5771	—627	0.030112	—170	30	24.0366	—656	0.039975	—197
5	20.6398	627	0.030282	170	35	24.1022	656	0.040172	196
10	20.7025	628	0.030452	170	40	24.1678	657	0.040368	198
15	20.7653	628	0.030622	171	45	24.2335	658	0.040566	198
20	20.8281	629	0.030793	172	50	24.2993	658	0.040764	198
25	20.8910	629	0.030965	172	55	24.3651	659	0.040962	199
30	20.9539	—630	0.031137	—172	35 0	24.4310	—660	0.041161	—199
35	21.0169	630	0.031309	173	5	24.4970	660	0.041360	200
40	21.0799	631	0.031482	174	10	24.5630	661	0.041560	201
45	21.1430	631	0.031656	174	15	24.6291	661	0.041761	201
50	21.2061	632	0.031830	174	20	24.6952	662	0.041962	201
55	21.2693	633	0.032004	175	25	24.7614	663	0.042163	202
31 0	21.3326	—632	0.032179	—175	30	24.8277	—663	0.042365	—202
5	21.3958	634	0.032354	176	35	24.8940	664	0.042567	203
10	21.4592	634	0.032530	177	40	24.9604	664	0.042770	204
15	21.5226	634	0.032707	177	45	25.0268	665	0.042974	204
20	21.5860	635	0.032884	177	50	25.0933	666	0.043178	204
25	21.6495	635	0.033061	178	55	25.1599	666	0.043382	205
30	21.7130	—636	0.033239	—178	36 0	25.2265	—667	0.043587	—206

Angle.	Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle.	Mean Mot.	Diff.	Log. Diſt.	Diff.
° ′		—667		—206	° ′		—704		—233
36 5	25.2932	668	0 043793	206	40 35	28.9946	706	0.055650	234
10	25.3600	668	0 043999	206	40	29.0652	706	0.055884	235
15	25.4268	669	0.044205	207	45	29.1358	706	0.056119	234
20	25 4937	670	0.044412	208	50	29.2064	708	0.056353	236
25	25.5607	670	0.044620	208	55	29.2772	708	0.056589	236
30	25.6277	—671	0.044828	—209	41 0	29.3480	—709	0.056825	—236
35	25.6948	671	0.045037	209	5	29.4189	710	0.057061	237
40	25.7619	672	0.045246	209	10	29 4899	710	0.057298	238
45	25.8291	673	0.045455	210	15	29.5609	711	0.057536	238
50	25.8964	673	0.045665	211	20	29.6320	712	0.057774	238
55	25.9637	674	0.045876	211	25	29.7032	713	0 058012	239
37 0	26 0311	—675	0.046087	—211	30	29 7745	—714	0.058251	—240
5	26.0986	675	0.046298	213	35	29.8459	714	0.058491	240
10	26.1661	676	0.046511	212	40	29.9173	715	0.058731	240
15	26.2337	677	0.046723	213	45	29.9888	716	0.058971	242
20	26.3014	677	0.046936	214	50	30.0604	717	0.059213	241
25	26.3691	678	0.047150	214	55	30.1321	718	0.059454	243
30	26.4369	—679	0.047364	—215	42 0	30.2039	—718	0.059697	—242
35	26.5048	679	0.047579	215	5	30.2757	719	0.059939	244
40	26.5727	680	0.047794	216	10	30.3476	720	0.060183	243
45	26.6407	681	0.048010	216	15	30.4196	721	0.060426	245
50	26.7088	682	0 048226	217	20	30.4917	722	0.060671	244
55	26.7770	682	0.048443	217	25	30.5639	722	0.060915	246
38 0	26.8452	—682	0.048660	—218	30	30.6361	—724	0.061161	—246
5	26.9134	684	0.048878	218	35	30.7085	724	0.061407	246
10	26.9818	684	0.049096	219	40	30.7809	725	0.061653	247
15	27.0502	685	0.049315	219	45	30.8534	725	0.061900	248
20	27.1187	685	0.049534	220	50	30.9259	727	0.062148	248
25	27.1872	687	0.049754	220	55	30.9986	727	0.062396	248
30	27.2559	—687	0.049974	—221	43 0	31.0713	—728	0.062644	—249
35	27.3246	687	0.050195	221	5	31.1441	729	0.062893	250
40	27.3933	688	0.050416	222	10	31.2170	730	0.063143	250
45	27.4621	689	0.050638	223	15	31.2900	731	0.063393	251
50	27.5310	690	0.050861	222	20	31.3631	732	0.063644	251
55	27.6000	691	0.051083	224	25	31.4363	732	0.063895	252
39 0	27.6691	—691	0.051307	—224	30	31.5095	—734	0.064147	—252
5	27.7382	692	0.051531	224	35	31.5829	734	0.064399	253
10	27.8074	692	0.051755	225	40	31.6563	735	0.064652	253
15	27.8766	693	0.051980	226	45	31.7298	735	0 064905	254
20	27.9459	694	0.052206	226	50	31.8033	737	0.065159	254
25	28.0153	695	0.052432	226	55	31.8770	738	0.065413	255
30	28.0848	—696	0.052658	—227	44 0	31.9508	—738	0.065668	—256
35	28.1544	696	0.052885	228	5	32.0246	740	0.065924	256
40	28.2240	697	0.053113	228	10	32.0986	740	0.066180	256
45	28.2937	697	0.053341	229	15	32.1726	741	0.066436	257
50	28.3634	699	0.053570	229	20	32.2467	742	0.066693	258
55	28.4333	699	0.053799	229	25	32.3209	743	0.066951	258
40 0	28.5032	—700	0.054028	—231	30	32.3952	—743	0.067209	—259
5	28.5732	700	0.054259	230	35	32.4695	745	0.067468	259
10	28.6432	702	0.054489	231	40	32.5440	745	0 067727	260
15	28.7134	702	0.054720	232	45	32.6185	747	0.067987	260
20	28.7836	703	0.054952	232	50	32.6932	747	0.068247	261
25	28.8539	703	0.055184	233	55	32.7679	748	0.068508	261
30	28.9242	—704	0 055417	—233	45 0	32.8427	—749	0.068769	—262

N. B. Here the ſecond column begins to be the Logarithm of the Mean Motion.

Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
°	′		—989		—262	°	′		—940		—292
45	5	1.517428	989	0.069031	263	49	35	1.569434	939	0.083983	292
	10	1.518417	987	0.069294	263		40	1.570373	939	0.084275	292
	15	1.519404	986	0.069557	263		45	1.571312	938	0.084567	294
	20	1.520390	986	0.069820	264		50	1.572250	937	0.084861	293
	25	1.521376	984	0.070084	265		55	1.573187	936	0.085154	295
	30	1.522360	—983	0.070349	—265	50	0	1.574123	—936	0.085449	—294
	35	1.523343	982	0.070614	266		5	1.575059	935	0.085743	296
	40	1.524325	981	0.070880	266		10	1.575994	934	0.086039	296
	45	1.525306	980	0.071146	267		15	1.576928	934	0.086335	296
	50	1.526286	979	0.071413	267		20	1.577862	932	0.086631	297
	55	1.527265	978	0.071680	268		25	1.578794	932	0.086928	298
46	0	1.528243	—978	0.071948	—268		30	1.579726	—932	0.087226	—298
	5	1.529221	976	0.072216	269		35	1.580658	930	0.087524	299
	10	1.530197	975	0.072485	270		40	1.581588	930	0.087823	299
	15	1.531172	974	0.072755	270		45	1.582518	929	0.088122	300
	20	1.532146	973	0.073025	270		50	1.583447	928	0.088422	301
	25	1.533119	972	0.073295	271		55	1.584375	928	0.088723	301
	30	1.534091	—972	0.073566	—272	51	0	1.585303	—927	0.089024	—301
	35	1.535063	970	0.073838	272		5	1.586230	926	0.089325	302
	40	1.536033	969	0.074110	273		10	1.587156	926	0.089627	303
	45	1.537002	969	0.074383	273		15	1.588082	925	0.089930	303
	50	1.537971	967	0.074656	274		20	1.589007	924	0.090233	304
	55	1.538938	967	0.074930	274		25	1.589931	924	0.090537	304
47	0	1.539905	—965	0.075204	—275		30	1.590855	—923	0.090841	—305
	5	1.540870	965	0.075479	276		35	1.591778	922	0.091146	306
	10	1.541835	964	0.075755	276		40	1.592700	922	0.091452	306
	15	1.542799	963	0.076031	276		45	1.593622	921	0.091758	307
	20	1.543762	962	0.076307	278		50	1.594543	920	0.092065	307
	25	1.544724	961	0.076585	277		55	1.595463	920	0.092372	308
	30	1.545685	—960	0.076862	—278	52	0	1.596383	—919	0.092680	—308
	35	1.546645	959	0.077140	279		5	1.597302	918	0.092988	309
	40	1.547604	959	0.077419	279		10	1.598220	918	0.093297	309
	45	1.548563	957	0.077698	280		15	1.599138	917	0.093606	310
	50	1.549520	957	0.077978	281		20	1.600055	917	0.093916	311
	55	1.550477	956	0.078259	281		25	1.600972	916	0.094227	311
48	0	1.551433	—955	0.078540	—281		30	1.601888	—915	0.094538	—312
	5	1.552388	954	0.078821	282		35	1.602803	915	0.094850	312
	10	1.553342	953	0.079103	283		40	1.603718	914	0.095162	313
	15	1.554295	952	0.079386	283		45	1.604632	913	0.095475	314
	20	1.555247	952	0.079669	284		50	1.605545	913	0.095789	314
	25	1.556199	950	0.079953	284		55	1.606458	912	0.096103	315
	30	1.557149	—950	0.080237	—285	53	0	1.607370	—912	0.096418	—315
	35	1.558099	949	0.080522	285		5	1.608282	911	0.096733	316
	40	1.559048	948	0.080807	286		10	1.609193	911	0.097049	316
	45	1.559996	948	0.081093	287		15	1.610104	910	0.097365	317
	50	1.560944	946	0.081380	287		20	1.611014	909	0.097682	318
	55	1.561890	946	0.081667	287		25	1.611923	909	0.098000	318
49	0	1.562836	—945	0.081954	—288		30	1.612832	—908	0.098318	—318
	5	1.563781	944	0.082242	289		35	1.613740	907	0.098636	319
	10	1.564725	943	0.082531	289		40	1.614647	907	0.098955	320
	15	1.565668	943	0.082820	290		45	1.615554	907	0.099275	321
	20	1.566611	942	0.083110	290		50	1.616461	906	0.099596	321
	25	1.567553	941	0.083400	291		55	1.617367	905	0.099917	321
	30	1.568494	—940	0.083691	—292	54	0	1.618272	—905	0.100238	—322

Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
°	′					°	′				
54	5	1.619177	—905	0.100560	—322	58	35	1.667334	—881	0.118827	—354
	10	1.620081	904	0.100883	323		40	1.668214	880	0.119182	355
	15	1.620985	904	0.101206	323		45	1.669095	881	0.119537	355
	20	1.621888	903	0.101530	324		50	1.669975	880	0.119893	356
	25	1.622791	903	0.101855	325		55	1.670854	879	0.120249	356
	30	1.623694	903	0.102180	325	59	0	1.671733	879	0.120606	357
	35	1.624595	—901	0.102505	—325		5	1.672612	—879	0.120964	—358
	40	1.625496	901	0.102832	327		10	1.673490	878	0.121322	358
	45	1.626397	901	0.103158	326		15	1.674369	879	0.121681	359
	50	1.627297	900	0.103486	328		20	1.675247	878	0.122041	360
	55	1.628197	900	0.103814	328		25	1.676124	877	0.122401	360
55	0	1.629096	899	0.104142	328		30	1.677001	877	0.122762	361
	5	1.629995	—899	0.104471	—329		35	1.677878	—877	0.123123	—361
	10	1.630893	898	0.104801	330		40	1.678755	877	0.123485	362
	15	1.631790	897	0.105131	330		45	1.679631	876	0.123847	362
	20	1.632688	898	0.105462	331		50	1.680507	876	0.124211	364
	25	1.633584	896	0.105794	332		55	1.681383	876	0.124574	363
	3	1.63448	896	0.106126	332	60	0	1.682258	875	0.124939	365
	35	1.635376	—896	0.106458	—332		5	1.683133	—875	0.125304	—365
	40	1.636271	895	0.106791	333		10	1.684008	875	0.125669	365
	45	1.637166	895	0.107125	334		15	1.684883	875	0.126036	367
	50	1.638060	894	0.107460	335		20	1.685757	874	0.126402	366
	55	1.638954	894	0.107795	335		25	1.686631	874	0.126770	368
56	0	1.639848	894	0.108130	335		30	1.687504	873	0.127138	368
	5	1.640740	—892	0.108466	—336		35	1.688378	—874	0.127507	—369
	10	1.641633	893	0.108803	337		40	1.689251	873	0.127876	369
	15	1.642525	892	0.109140	337		45	1.690124	873	0.128246	370
	20	1.643417	892	0.109478	338		50	1.690997	873	0.128616	370
	25	1.644308	891	0.109817	339		55	1.691869	872	0.128987	371
	3	1.645199	891	0.110156	339	61	0	1.692741	872	0.129359	372
	35	1.646089	—890	0.110496	—340		5	1.693613	—872	0.129732	—373
	40	1.646978	889	0.110836	340		10	1.694484	871	0.130105	373
	45	1.647868	890	0.111177	341		15	1.695355	871	0.130478	373
	50	1.648757	889	0.111518	341		20	1.696226	871	0.130852	374
	55	1.649645	888	0.111860	342		25	1.697097	871	0.131227	375
57	0	1.650534	889	0.112203	343		30	1.697968	871	0.131603	376
	5	1.651421	—887	0.112546	—343		35	1.698838	—870	0.131979	—376
	10	1.652309	888	0.112890	344		40	1.699708	870	0.132356	377
	15	1.653196	887	0.113235	345		45	1.700578	870	0.132733	377
	20	1.654082	886	0.113580	345		50	1.701448	870	0.133111	378
	25	1.654968	886	0.113925	345		55	1.702317	869	0.133490	379
	30	1.655854	886	0.114271	346	62	0	1.703186	869	0.133869	379
	35	1.656739	—885	0.114618	—347		5	1.704055	—869	0.134249	—380
	40	1.657624	885	0.114966	348		10	1.704924	869	0.134629	380
	45	1.658509	885	0.115314	348		15	1.705793	869	0.135010	381
	50	1.659393	884	0.115662	348		20	1.706661	868	0.135392	382
	55	1.660277	884	0.116012	350		25	1.707529	868	0.135774	382
58	0	1.661160	883	0.116362	350		30	1.708397	868	0.136157	383
	5	1.662043	—883	0.116712	—350		35	1.709265	—868	0.136541	—384
	10	1.662926	883	0.117063	351		40	1.710133	868	0.136925	384
	15	1.663808	882	0.117415	352		45	1.711000	867	0.137310	385
	20	1.664690	882	0.117767	352		50	1.711867	867	0.137696	386
	25	1.665572	882	0.118120	353		55	1.712734	867	0.138082	386
	30	1.666453	881	0.118473	353	63	0	1.713601	867	0.138468	386
			—881		—354				—866		—388

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
63	5	1.714467	—866	0.138856	—388
	10	1.715334	867	0.139244	388
	15	1.716200	866	0.139633	389
	20	1.717066	866	0.140022	389
	25	1.717932	866	0.140412	390
	30	1.718797	865	0.140802	390
	35	1.719663	—866	0.141193	—391
	40	1.720528	865	0.141585	392
	45	1.721393	865	0.141978	393
	50	1.722258	865	0.142371	393
	55	1.723123	865	0.142765	394
64	0	1.723988	865	0.143159	394
	5	1.724853	—865	0.143554	—395
	10	1.725717	864	0.143950	396
	15	1.726681	864	0.144346	396
	20	1.727446	865	0.144743	397
	25	1.728310	864	0.145141	398
	30	1.729173	863	0.145539	398
	35	1.730037	—864	0.145938	—399
	40	1.730901	864	0.146337	399
	45	1.731764	863	0.146737	400
	50	1.732628	864	0.147138	401
	55	1.733491	863	0.147540	402
65	0	1.734354	863	0.147942	402
	5	1.735217	—863	0.148344	—402
	10	1.736080	863	0.148748	404
	15	1.736943	863	0.149152	404
	20	1.737805	862	0.149556	404
	25	1.738668	863	0.149962	406
	30	1.739530	862	0.150368	406
	35	1.740393	—863	0.150774	—406
	40	1.741255	862	0.151182	408
	45	1.742117	862	0.151590	408
	50	1.742979	862	0.151998	408
	55	1.743841	862	0.152407	409
66	0	1.744703	862	0.152817	410
	5	1.745565	—862	0.153228	—411
	10	1.746427	862	0.153639	411
	15	1.747288	861	0.154051	412
	20	1.748150	862	0.154463	412
	25	1.749012	862	0.154876	413
	30	1.749873	861	0.155290	414
	35	1.750734	—861	0.155705	—415
	40	1.751596	862	0.156120	415
	45	1.752457	861	0.156536	416
	50	1.753318	861	0.156952	416
	55	1.754179	861	0.157369	417
67	0	1.755040	861	0.157787	418
	5	1.755902	—862	0.158205	—418
	10	1.756763	861	0.158624	419
	15	1.757623	860	0.159044	420
	20	1.758484	861	0.159465	421
	25	1.759345	861	0.159886	421
	30	1.760206	861	0.160307	421
			—861		—423

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
67	35	1.761067	—861	0.160730	—423
	40	1.761928	861	0.161153	423
	45	1.762788	860	0.161576	423
	50	1.763649	861	0.162001	425
	55	1.764510	861	0.162426	425
68	0	1.765371	861	0.162852	426
	5	1.766231	—860	0.163278	—426
	10	1.767092	861	0.163705	427
	15	1.767953	861	0.164133	428
	20	1.768813	860	0.164561	428
	25	1.769674	861	0.164990	429
	30	1.770535	861	0.165420	430
	35	1.771395	—860	0.165850	—430
	40	1.772256	861	0.166281	431
	45	1.773116	860	0.166713	432
	50	1.773977	861	0.167146	433
	55	1.774838	861	0.167579	433
69	0	1.775698	860	0.168013	434
	5	1.776559	—861	0.168447	—434
	10	1.777420	861	0.168882	435
	15	1.778281	861	0.169318	436
	20	1.779141	860	0.169754	436
	25	1.780002	861	0.170192	438
	30	1.780863	861	0.170630	438
	35	1.781724	—861	0.171068	—438
	40	1.782584	860	0.171507	439
	45	1.783445	861	0.171947	440
	50	1.784306	861	0.172388	441
	55	1.785167	861	0.172829	441
70	0	1.786028	861	0.173271	442
	5	1.786889	—861	0.173714	—443
	10	1.787751	862	0.174157	443
	15	1.788612	861	0.174601	444
	20	1.789473	861	0.175046	445
	25	1.790334	861	0.175491	445
	30	1.791195	861	0.175937	446
	35	1.792057	—862	0.176384	—447
	40	1.792918	861	0.176831	447
	45	1.793780	862	0.177279	448
	50	1.794642	862	0.177728	449
	55	1.795503	861	0.178178	450
71	0	1.796365	862	0.178628	450
	5	1.797227	—862	0.179079	—451
	10	1.798089	862	0.179530	451
	15	1.798951	862	0.179983	453
	20	1.799813	862	0.180436	453
	25	1.800675	862	0.180889	453
	30	1.801537	862	0.181344	455
	35	1.802400	—863	0.181799	—455
	40	1.803262	862	0.182255	456
	45	1.804124	862	0.182711	456
	50	1.804987	863	0.183168	457
	55	1.805850	863	0.183626	458
72	0	1.806713	863	0.184085	459
			—863		—459

Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
°	′		—863		—459	°	′		—873		—498
72	5	1.807576	863	0.184544	460	76	35	1.854410	873	0.210408	499
	10	1.808439	863	0.185004	461		40	1.855283	873	0.210907	500
	15	1.809302	863	0.185465	461		45	1.856156	873	0.211407	501
	20	1.810165	864	0.185926	462		50	1.857029	874	0.211908	501
	25	1.811029	863	0.186388	463		55	1.857903	874	0.212409	502
	30	1.811892	—864	0.186851	—463	77	0	1.858777	—874	0.212911	—503
	35	1.812756	864	0 187314	465		5	1.859651	875	0.213414	504
	40	1.813620	864	0.187779	465		10	1.860526	874	0.213918	504
	45	1.814484	864	0.188244	465		15	1.861400	875	0.214422	505
	50	1.815348	864	0.188709	467		20	1 862275	876	0.214927	506
	55	1.816212	865	0.189176	467		25	1 863151	875	0.215433	506
73	0	1.817077	—864	0.189643	—467		30	1.864026	—876	0.215939	—508
	5	1.817941	864	0.190110	469		35	1.864902	876	0.216447	508
	10	1.818805	865	0.190579	469		40	1.865778	877	0.216955	509
	15	1.819670	865	0.191048	470		45	1.866655	877	0.217464	509
	20	1.820535	865	0.191518	470		50	1.867532	876	0.217973	511
	25	1.821400	866	0.191988	472		55	1.868408	878	0.218484	511
	30	1.822266	—865	0.192460	—472	78	0	1 869286	—877	0.218995	—512
	35	1.823131	866.	0.192932	473		5	1.870163	878	0.219507	512
	40	1.823997	865	0 193405	473		10	1.871041	878	0.220019	514
	45	1.824862	866	0.193878	474		15	1.871919	879	0.220533	514
	50	1.825728	866	0.194352	475		20	1.872798	879	0.221047	515
	55	1.826594	866	0.194827	476		25	1.873677	879	0.221562	516
74	0	1.827460	—867	0.195303	—476		30	1.874556	—879	0.222078	—516
	5	1.828327	866	0.195779	477		35	1.875435	880	0.222594	517
	10	1.829193	867	0.196256	478		40	1.876315	880	0.223111	518
	15	1.830060	867	0.196734	479		45	1.877195	880	0.223629	519
	20	1.830927	867	0.197213	479		50	1.878075	881	0.224148	520
	25	1 831794	867	0.197692	480		55	1.878956	881	0.224668	520
	30	1.832661	—868	0.198172	—480	79	0	1.879837	—881	0.225188	—521
	35	1.833529	867	0.198652	482		5	1.880718	882	0.225709	522
	40	1.834396	868	0.199134	482		10	1.881600	882	0.226231	522
	45	1.835264	868	0.199616	483		15	1.882482	882	0.226753	524
	50	1.836132	868	0.200099	483		20	1.883364	883	0.227277	524
	55	1.837000	869	0.200582	485		25	1.884247	883	0.227801	525
75	0	1.837869	—868	0.201067	—485		30	1.885130	—883	0.228326	—526
	5	1.838737	869	0.201552	486		35	1.886013	884	0.228852	526
	10	1.839606	869	0.202038	486		40	1.886897	884	0.229378	528
	15	1.840475	869	0.202524	487		45	1.887781	884	0.229906	528
	20	1.841344	870	0.203011	488		50	1.888665	885	0.230434	528
	25	1.842214	869	0.203499	489		55	1.889550	885	0.230962	530
	30	1.843083	—870	0.203988	—489	80	0	1.890435	—885	0.231492	—530
	35	1.843953	870	0.204477	491		5	1.891320	886	0.232022	532
	40	1.844823	871	0.204968	491		10	1.892206	886	0.232554	532
	45	1.845694	870	0.205459	491		15	1.893092	887	0.233086	532
	50	1.846564	871	0.205950	493		20	1.893979	887	0.233618	534
	55	1.847435	871	0.206443	493		25	1.894866	887	0.234152	534
76	0	1.848306	—871	0.206936	—494		30	1.895753	—887	0 234686	—535
	5	1.849177	872	0.207430	494		35	1.896640	888	0.235221	536
	10	1.850049	871	0.207924	496		40	1.897528	889	0.235757	537
	15	1.850920	872	0.208420	496		45	1.898417	888	0.236294	538
	20	1.851792	872	0.208916	496		50	1.899305	889	0.236832	538
	25	1.852664	873	0.209412	498		55	1.900194	890	0.237370	539
	30	1.853537	—873	0 209910	—498	81	0	1.901084	—890	0.237909	—540

Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle.		Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
°	′					°	′				
81	5	1.901974	—890	0.238449	—540	85	35	1.950678	—915	0.268811	—585
	10	1.902864	890	0.238990	541		40	1.951593	915	0.269396	585
	15	1.903755	891	0.239531	541		45	1.952509	916	0 269982	586
	20	1.904646	891	0.240073	542		50	1.953426	917	0.270569	587
	25	1.905537	891	0.240616	543		55	1.954343	917	0.271156	587
	30	1.906429	892	0.241160	544	86	0	1.955260	917	0.271745	589
	35	1.907321	—892	0.241705	—545		5	1.956178	—918	0.272335	—590
	40	1 908214	893	0.242250	545		10	1.957097	919	0.272925	590
	45	1.909107	893	0.242797	547		15	1.958016	919	0.273516	591
	50	1.910001	894	0.243344	547		20	1.958936	920	0.274108	592
	55	1.910895	894	0.243892	548		25	1.959856	920	0.274701	593
82	0	1.911789	894	0.244440	548		30	1.960777	921	0.275295	594
	5	1.912684	—895	0.244990	—550		35	1.961698	—921	0.275889	—594
	10	1.913579	895	0.245540	550		40	1.962620	922	0.276485	596
	15	1.914475	896	0 246091	551		45	1.963543	923	0.277081	596
	20	1.915371	896	0 246643	552		50	1.964466	923	0.277678	597
	25	1.916267	896	0.247196	553		55	1.965390	924	0.278277	599
	30	1.917164	897	0.247749	553	87	0	1 966314	924	0.278876	599
	35	1.918061	—897	0.248304	—555		5	1.967239	—925	0.279475	—599
	40	1.918959	898	0.248859	555		10	1.968164	925	0.280076	601
	45	1.919857	898	0.249415	556		15	1.969090	926	0.280678	602
	50	1.920756	899	0.249972	557		20	1.970017	927	0.281280	602
	55	1.921655	899	0.250529	557		25	1.970944	927	0.281884	604
83	0	1.922555	900	0.251088	559		30	1 971872	928	0.282488	604
	5	1.923455	—900	0.251647	—559		35	1.972801	—929	0.283093	—605
	10	1.924355	900	0.252207	560		40	1.973730	929	0.283699	606
	15	1.925256	901	0.252768	561		45	1.974659	929	0.284306	607
	20	1.926157	901	0.253330	562		50	1.975589	930	0.284914	608
	25	1.927059	902	0.253892	562		55	1.976520	931	0.285522	608
	30	1.927962	903	0.254456	564	88	0	1.977452	932	0.286132	610
	35	1.928865	—903	0.255020	—564		5	1.978384	—932	0.286742	—610
	40	1.929768	903	0.255585	565		10	1.979317	933	0.287354	612
	45	1.930671	903	0.256151	566		15	1 980250	933	0.287966	612
	50	1.931575	904	0.256717	566		20	1.981184	934	0.288579	613
	55	1.932480	905	0.257285	568		25	1.982119	935	0.289193	614
84	0	1.933385	905	0.257853	568		30	1.983054	935	0.289808	615
	5	1.934291	—906	0.258422	—569		35	1.983990	—936	0.290424	—616
	10	1.935197	906	0.258992	570		40	1.984926	936	0.291040	616
	15	1.936104	907	0.259563	571		45	1.985864	938	0.291658	618
	20	1.937011	907	0.260135	572		50	1.986801	937	0.292276	618
	25	1.937918	907	0.260707	572		55	1.987740	939	0.292896	620
	30	1.938826	908	0 261281	574	89	0	1.988679	939	0.293516	620
	35	1.939735	—909	0.261855	—574		5	1.989619	—940	0.294137	—621
	40	1.940644	909	0.262430	575		10	1.990559	940	0.294759	622
	45	1.941554	910	0.263006	576		15	1.991500	941	0.295382	623
	50	1.942464	910	0.263582	576		20	1.992442	942	0.296006	624
	55	1.943374	910	0.264160	578		25	1.993384	942	0.296631	625
85	0	1.944285	911	0.264738	578		30	1.994327	943	0.297257	626
	5	1.945197	—912	0.265317	—579		35	1 995271	—944	0.297883	—626
	10	1.946109	912	0.265897	580		40	1 996216	945	0.298511	628
	15	1.947022	913	0.266478	581		45	1.997161	945	0 299139	628
	20	1.947935	913	0.267060	582		50	1 998107	946	0.299769	630
	25	1.948849	914	0.267643	583		55	1.999053	946	0.300399	630
	30	1.949763	914	0.268226	583	90	0	2.000000	947	0.301030	631
			—915		—585				—948		—632

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
90	5	2.000948	—948	0.301662	—632	94	35	2.053239	—989	0.337199	—684
	10	2.001897	949	0.302295	633		40	2.054230	991	0.337884	685
	15	2.002846	949	0.302929	634		45	2.055221	991	0.338570	686
	20	2.003796	950	0.303564	635		50	2.056213	992	0.339257	687
	25	2.004746	950	0.304200	636		55	2.057206	993	0.339944	687
	30	2.005697	951	0.304837	637	95	0	2.058200	994	0.340633	689
	35	2.006649	—952	0.305474	—637		5	2.059195	—995	0.341323	—690
	40	2.007602	953	0.306113	639		10	2.060191	996	0.342014	691
	45	2.008556	954	0.306752	639		15	2.061188	997	0.342706	692
	50	2.009510	954	0.307393	641		20	2.062185	997	0.343399	693
	55	2.010465	955	0.308034	641		25	2.063184	999	0.344093	694
91	0	2.011420	955	0.308676	642		30	2.064183	999	0.344787	694
	5	2.012377	—957	0.309320	—644		35	2.065183	—1000	0.345483	—696
	10	2.013334	957	0.309964	644		40	2.066184	1001	0.346180	697
	15	2.014292	958	0.310609	645		45	2.067186	1002	0.346878	698
	20	2.015250	958	0.311255	646		50	2.068189	1003	0.347577	699
	25	2.016209	959	0.311902	647		55	2.069193	1004	0.348277	700
	30	2.017169	960	0.312550	648	96	0	2.070198	1005	0.348978	701
	35	2.018130	—961	0.313199	—649		5	2.071204	—1006	0.349680	—702
	40	2.019091	961	0.313849	650		10	2.072211	1007	0.350383	703
	45	2.020054	963	0.314499	650		15	2.073218	1007	0.351087	704
	50	2.021017	963	0.315151	652		20	2.074226	1008	0.351793	706
	55	2.021981	964	0.315804	653		25	2.075236	1010	0.352499	706
92	0	2.022945	964	0.316457	653		30	2.076246	1010	0.353206	707
	5	2.023910	—965	0.317112	—655		35	2.077257	—1011	0.353914	—708
	10	2.024876	966	0.317768	656		40	2.078270	1013	0.354623	709
	15	2.025843	967	0.318424	656		45	2.079283	1013	0.355334	711
	20	2.026811	968	0.319081	657		50	2.080297	1014	0.356045	711
	25	2.027779	968	0.319740	659		55	2.081312	1015	0.356757	712
	30	2.028748	969	0.320399	659	97	0	2.082328	1016	0.357471	714
	35	2.029718	—970	0.321060	—661		5	2.083345	—1017	0.358185	—714
	40	2.030689	971	0.321721	661		10	2.084363	1018	0.358901	716
	45	2.031660	971	0.322383	662		15	2.085382	1019	0.359617	716
	50	2.032633	973	0.323046	663		20	2.086402	1020	0.360335	718
	55	2.033606	973	0.323710	664		25	2.087423	1021	0.361054	719
93	0	2.034580	974	0.324376	666		30	2.088445	1022	0.361773	719
	5	2.035554	—974	0.325042	—666		35	2.089468	—1023	0.362494	—721
	10	2.036530	976	0.325709	667		40	2.090492	1024	0.363216	722
	15	2.037506	976	0.326377	668		45	2.091517	1025	0.363939	723
	20	2.038483	977	0.327046	669		50	2.092542	1025	0.364663	724
	25	2.039461	978	0.327716	670		55	2.093569	1027	0.365388	725
	30	2.040440	979	0.328387	671	98	0	2.094597	1028	0.366114	726
	35	2.041419	—979	0.329059	—672		5	2.095626	—1029	0.366841	—727
	40	2.042400	981	0.329732	673		10	2.096656	1030	0.367570	729
	45	2.043381	981	0.330406	674		15	2.097687	1031	0.368299	729
	50	2.044363	982	0.331081	675		20	2.098719	1032	0.369029	730
	55	2.045346	983	0.331757	676		25	2.099752	1033	0.369761	732
94	0	2.046330	984	0.332433	676		30	2.100785	1033	0.370493	732
	5	2.047314	—984	0.333111	—678		35	2.101820	—1035	0.371227	—734
	10	2.048299	985	0.333790	679		40	2.102856	1036	0.371962	735
	15	2.049286	987	0.334470	680		45	2.103893	1037	0.372697	735
	20	2.050273	987	0.335151	681		50	2.104931	1038	0.373434	737
	25	2.051261	988	0.335833	682		55	2.105971	1040	0.374172	738
	30	2.052250	989	0.336515	682	99	0	2.107011	1040	0.374911	739
			—989		—684				—1041		—740

Angle. °	'	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
99	5	2.108052	—1041	0.375651	—740
	10	2.109094	1042	0.376392	741
	15	2.110138	1044	0.377135	743
	20	2.111182	1044	0.377878	743
	25	2.112227	1045	0.378623	745
	30	2.113274	1047	0.379368	745
	35	2.114322	—1048	0.380115	—747
	40	2.115370	1048	0.380863	748
	45	2.116420	1050	0.381612	749
	50	2.117471	1051	0.382362	750
	55	2.118523	1052	0.383113	751
100	0	2.119576	1053	0.383865	752
	5	2.120630	—1054	0.384618	—753
	10	2.121685	1055	0.385373	755
	15	2.122742	1057	0.386128	755
	20	2.123799	1057	0.386885	757
	25	2.124857	1058	0.387643	758
	30	2.125917	1060	0.388402	759
	35	2.126978	—1061	0.389162	—760
	40	2.128040	1062	0.389923	761
	45	2.129103	1063	0.390685	762
	50	2.130167	1064	0.391449	764
	55	2.131232	1065	0.392213	764
101	0	2.132299	1067	0.392979	766
	5	2.133367	—1068	0.393746	—767
	10	2.134435	1068	0.394514	768
	15	2.135505	1070	0.395283	769
	20	2.136576	1071	0.396053	770
	25	2.137648	1072	0.396824	771
	30	2.138722	1074	0.397597	773
	35	2.139796	—1074	0.398371	—774
	40	2.140872	1076	0.399146	775
	45	2.141949	1077	0.399922	776
	50	2.143027	1078	0.400699	777
	55	2.144106	1079	0.401477	778
102	0	2.145187	1081	0.402256	779
	5	2.146268	—1081	0.403037	—781
	10	2.147351	1083	0.403819	782
	15	2.148435	1084	0.404602	783
	20	2.149520	1085	0.405386	784
	25	2.150607	1087	0.406171	785
	30	2.151695	1088	0.406957	786
	35	2.152783	—1088	0.407745	—788
	40	2.153873	1090	0.408534	789
	45	2.154965	1092	0.409324	790
	50	2.156057	1092	0.410115	791
	55	2.157151	1094	0.410907	792
103	0	2.158246	1095	0.411701	794
	5	2.159342	—1096	0.412496	—795
	10	2.160440	1098	0.413292	796
	15	2.161539	1099	0.414089	797
	20	2.162639	1100	0.414887	798
	25	2.163740	1101	0.415686	799
	30	2.164842	1102	0.416487	801
			—1104		—802

Angle. °	'	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
103	35	2.165946	—1104	0.417289	—802
	40	2.167051	1105	0.418092	803
	45	2.168158	1107	0.418896	804
	50	2.169265	1107	0.419701	805
	55	2.170374	1109	0.420508	807
104	0	2.171484	1110	0.421316	808
	5	2.172596	—1112	0.422125	—809
	10	2.173709	1113	0.422935	810
	15	2.174823	1114	0.423747	812
	20	2.175938	1115	0.424560	813
	25	2.177055	1117	0.425374	814
	30	2.178173	1118	0.426189	815
	35	2.179292	—1119	0.427005	—816
	40	2.180413	1121	0.427823	818
	45	2.181535	1122	0.428642	819
	50	2.182658	1123	0.429462	820
	55	2.183783	1125	0.430283	821
105	0	2.184909	1126	0.431106	823
	5	2.186036	—1127	0.431930	—824
	10	2.187165	1129	0.432755	825
	15	2.188295	1130	0.433581	826
	20	2.189427	1132	0.434408	827
	25	2.190560	1133	0.435237	829
	30	2.191694	1134	0.436067	830
	35	2.192830	—1136	0.436899	—832
	40	2.193967	1137	0.437731	832
	45	2.195105	1138	0.438565	834
	50	2.196245	1140	0.439400	835
	55	2.197386	1141	0.440236	836
106	0	2.198528	1142	0.441074	838
	5	2.199672	—1144	0.441913	—839
	10	2.200817	1145	0.442753	840
	15	2.201964	1147	0.443594	841
	20	2.203112	1148	0.444437	843
	25	2.204262	1150	0.445281	844
	30	2.205413	1151	0.446126	845
	35	2.206565	—1152	0.446973	—847
	40	2.207719	1154	0.447821	848
	45	2.208875	1156	0.448670	849
	50	2.210031	1156	0.449520	850
	55	2.211189	1158	0.450372	852
107	0	2.212349	1160	0.451225	853
	5	2.213510	—1161	0.452079	—854
	10	2.214673	1163	0.452935	856
	15	2.215837	1164	0.453792	857
	20	2.217003	1166	0.454650	858
	25	2.218170	1167	0.455509	859
	30	2.219338	1168	0.456370	861
	35	2.220508	—1170	0.457232	—862
	40	2.221680	1172	0.458096	864
	45	2.222853	1173	0.458960	864
	50	2.224027	1174	0.459826	866
	55	2.225203	1176	0.460694	868
108	0	2.226381	1178	0.461563	869
			—1179		—870

Angle. ° ′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle. ° ′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
108 5	2.227560	—1179	0.462433	—870	112 35	2.293634	—1270	0.511468	— 946
10	2.228740	1180	0 463304	871	40	2.294[illegible]05	1271	0.512416	948
15	2.229922	1182	0.464177	873	45	2.296177	1272	0.513365	949
20	2 231106	1184	0 465051	874	50	2.297452	1275	0.514315	950
25	2.232291	1185	0.465926	875	55	2.298728	1276	0.515267	952
30	2.233478	1187	0.466803	877	113 0	2.300007	1279	0.516221	954
35	2.234666	—1188	0.467681	—878	5	2.301287	—1280	0.517176	— 955
40	2.235856	1190	0.468561	880	10	2.302569	1282	0.518133	957
45	2 237048	1192	0.469441	880	15	2.303853	1284	0.519091	958
50	2.238241	1193	0.470324	883	20	2.305139	1286	0.520050	959
55	2.239435	1194	0.471207	883	25	2.306426	1287	0 521012	962
109 0	2 240631	1196	0.472092	885	30	2.307716	1290	0.521974	962
5	2.241829	—1198	0.472978	—886	35	2.309007	—1291	0.522938	— 964
10	2.243028	1199	0.473866	888	40	2.310300	1293	0.523904	966
15	2.244229	1201	0.474755	889	45	2.311596	1296	0.524871	967
20	2 245432	1203	0.475645	890	50	2.312893	1297	0.525840	969
25	2.246636	1204	0.476537	892	55	2.314192	1299	0 526811	971
30	2 247842	1206	0.477430	893	114 0	2.315493	1301	0.527782	971
35	2.249049	—1207	0.478324	—894	5	2.316796	—1303	0.528756	— 974
40	2.250258	1209	0 479220	896	10	2.318101	1305	0.529731	975
45	2.251468	1210	0.480117	897	15	2.319407	1306	0.530707	976
50	2.252680	1212	0 481016	899	20	2.320716	1309	0.531686	979
55	2.253894	1214	0.481916	900	25	2.322027	1311	0.532665	979
110 0	2.255110	1216	0 482817	901	30	2.323339	1312	0.533646	981
5	2.256327	—1217	0.483720	—903	35	2.324654	—1315	0.534629	— 983
10	2.257546	1219	0 484624	904	40	2.325970	1316	0.535614	985
15	2.258766	1220	0.485530	906	45	2.327289	1319	0.536600	986
20	2.259988	1222	0.486437	907	50	2.328609	1320	0.537587	987
25	2.261212	1224	0.487345	908	55	2.329932	1323	0.538576	989
30	2.262437	1225	0.488255	910	115 0	2.331257	1325	0.539567	991
35	2.263664	—1227	0.489166	—911	5	2.332583	—1326	0.540559	— 992
40	2.264893	1229	0.490079	913	10	2.333912	1329	0.541553	994
45	2.266124	1231	0.490993	914	15	2.335242	1330	0.542549	996
50	2.267356	1232	0.491909	916	20	2.336575	1333	0.543546	997
55	2.268590	1234	0.492826	917	25	2.337909	1334	0.544545	999
111 0	2.269826	1236	0.493744	918	30	2.339246	1337	0.545545	1000
5	2.271063	—1237	0.494664	—920	35	2.340585	—1339	0.546547	—1002
10	2.272302	1239	0.495585	921	40	2.341925	1340	0.547550	1003
15	2.273543	1241	0.496508	923	45	2.343268	1343	0.548555	1005
20	2.274785	1242	0.497432	924	50	2.344613	1345	0.549562	1007
25	2.276029	1244	0.498357	925	55	2.345960	1347	0.550571	1009
30	2 277275	1246	0.499284	927	116 0	2.347309	1349	0.551581	1010
35	2.278523	—1248	0.500213	—929	5	2.348660	—1351	0.552592	—1[illegible]
40	2.279772	1249	0.501143	930	10	2.350014	1354	0.553606	1014
45	2.281023	1251	0.502074	931	15	2.351369	1355	0.554621	1015
50	2.282276	1253	0.503007	933	20	2.352726	1357	0.555637	1016
55	2.283531	1255	0.503941	934	25	2.354086	1360	0.556655	1018
112 0	2.284788	1257	0.504877	936	30	2.355448	1362	0.557675	1020
5	2.286046	—1258	0.505814	—937	35	2.356812	—1364	0.558697	—1022
10	2.287306	1260	0.506753	939	40	2.358177	1365	0.559720	1023
15	2.288568	1262	0.507693	940	45	2.359545	1368	0.560745	1025
20	2.289832	1264	0.508634	941	50	2.360916	1371	0.561772	1027
25	2.291097	1265	0.509577	943	55	2.362288	1372	0.562800	1028
30	2.292364	1267	0 510522	945	117 0	2.363663	1375	0.563830	1030
		—1270		—946			—1377		—1032

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
117	5	2.365040	—1377	0.564862	—1032	121	35	2.442820	—1506	0.623184	—1129
	10	2.366418	1378	0.565895	1033		40	2.444328	1508	0.624315	1131
	15	2.367799	1381	0.566930	1035		45	2.445839	1511	0.625448	1133
	20	2.369183	1384	0.567966	1036		50	2.447352	1513	0.626582	1134
	25	2.370568	1385	0.569005	1039		55	2.448868	1516	0.627719	1137
	30	2.371956	1388	0.570045	1040	122	0	2.450387	1519	0.628858	1139
	35	2.373346	—1390	0.571087	—1042		5	2.451908	—1521	0.629998	—1140
	40	2.374738	1392	0.572130	1043		10	2.453432	1524	0.631141	1143
	45	2.376132	1394	0.573175	1045		15	2.454959	1527	0.632285	1144
	50	2.377529	1397	0.574222	1047		20	2.456488	1529	0.633431	1146
	55	2.378928	1399	0.575271	1049		25	2.458020	1532	0.634580	1149
118	0	2.380329	1401	0.576321	1050		30	2.459555	1535	0.635730	1150
	5	2.381732	—1403	0.577373	—1052		35	2.461092	—1537	0.636882	—1152
	10	2.383138	1406	0.578427	1054		40	2.462632	1540	0.638037	1155
	15	2.384546	1408	0.579483	1056		45	2.464175	1543	0.639193	1156
	20	2.385956	1410	0.580540	1057		50	2.465721	1546	0.640351	1158
	25	2.387369	1413	0.581599	1059		55	2.467269	1548	0.641512	1161
	30	2.388784	1415	0.582660	1061	123	0	2.468821	1552	0.642674	1162
	35	2.390201	—1417	0.583723	—1063		5	2.470375	—1554	0.643839	—1165
	40	2.391620	1419	0.584787	1064		10	2.471931	1556	0.645005	1166
	45	2.393042	1422	0.585853	1066		15	2.473491	1560	0.646173	1168
	50	2.394466	1424	0.586921	1068		20	2.475053	1562	0.647344	1171
	55	2.395892	1426	0.587991	1070		25	2.476618	1565	0.648516	1172
119	0	2.397321	1429	0.589062	1071		30	2.478186	1568	0.649691	1175
	5	2.398752	—1431	0.590136	—1074		35	2.479756	—1570	0.650867	—1176
	10	2.400186	1434	0.591211	1075		40	2.481330	1574	0.652046	1179
	15	2.401622	1436	0.592287	1076		45	2.482907	1577	0.653227	1181
	20	2.403060	1438	0.593366	1079		50	2.484486	1579	0.654410	1183
	25	2.404500	1440	0.594446	1080		55	2.486068	1582	0.655594	1184
	30	2.405943	1443	0.595529	1083	124	0	2.487653	1585	0.656781	1187
	35	2.407389	—1446	0.596613	—1084		5	2.489241	—1588	0.657970	—1189
	40	2.408836	1447	0.597698	1085		10	2.490832	1591	0.659162	1192
	45	2.410287	1451	0.598786	1088		15	2.492425	1593	0.660355	1193
	50	2.411739	1452	0.599876	1090		20	2.494022	1597	0.661550	1195
	55	2.413194	1455	0.600967	1091		25	2.495621	1599	0.662747	1197
120	0	2.414652	1458	0.602060	1093		30	2.497224	1603	0.663947	1200
	5	2.416112	—1460	0.603155	—1095		35	2.498829	—1605	0.665149	—1202
	10	2.417574	1462	0.604252	1097		40	2.500437	1608	0.666352	1203
	15	2.419039	1465	0.605350	1098		45	2.502049	1612	0.667558	1206
	20	2.420507	1468	0.606451	1101		50	2.503663	1614	0.668766	1208
	25	2.421977	1470	0.607553	1102		55	2.505280	1617	0.669977	1211
	30	2.423449	1472	0.608658	1105	125	0	2.506901	1621	0.671189	1212
	35	2.424924	—1475	0.609764	—1106		5	2.508524	—1623	0.672403	—1214
	40	2.426401	1477	0.610872	1108		10	2.510150	1626	0.673620	1217
	45	2.427881	1480	0.611982	1110		15	2.511780	1630	0.674839	1219
	50	2.429363	1482	0.613093	1111		20	2.513412	1632	0.676060	1221
	55	2.430848	1485	0.614207	1114		25	2.515047	1635	0.677283	1223
121	0	2.432336	1488	0.615322	1115		30	2.516686	1639	0.678508	1225
	5	2.433826	—1490	0.616440	—1118		35	2.518327	—1641	0.679736	—1228
	10	2.435318	1492	0.617559	1119		40	2.519972	1645	0.680965	1229
	15	2.436813	1495	0.618680	1121		45	2.521620	1648	0.682197	1232
	20	2.438311	1498	0.619803	1123		50	2.523270	1650	0.683432	1235
	25	2.439811	1500	0.620928	1125		55	2.524924	1654	0.684668	1236
	30	2.441314	1503	0.622055	1127	126	0	2.526581	1657	0.685906	1238
			—1506		—1129				—1660		—1241

Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Diff.	Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Diff.
° ′		—1660		—1241	° ′		—1847		—1371
126 5	2.528241	1664	0.687147	1243	130 35	2.622869	1851	0.757649	1374
10	2.529905	1666	0.688390	1246	40	2.624720	1855	0.759023	1377
15	2.531571	1670	0.689636	1247	45	2 626575	1859	0.760400	1379
20	2.533241	1673	0.690883	1250	50	2.628434	1862	0.761779	1382
25	2.534914	1676	0.692133	1252	55	2.630296	1866	0.763161	1385
30	2.536590	—1679	0.693385	—1254	131 0	2.632162	—1870	0.764546	—1387
35	2.538269	1682	0.694639	1257	5	2.634032	1875	0.765933	1391
40	2.539951	1686	0.695896	1259	10	2.635907	1878	0.767324	1392
45	2.541637	1689	0.697155	1261	15	2.637785	1882	0.768716	1396
50	2.543326	1692	0.698416	1263	20	2.639667	1886	0.770112	1398
55	2.545018	1696	0.699679	1266	25	2.641553	1890	0.771510	1401
127 0	2.546714	—1698	0.700945	—1268	30	2.643443	—1893	0.772911	—1403
5	2.548412	1702	0.702213	1271	35	2.645336	1898	0.774314	1407
10	2.550114	1705	0.703484	1272	40	2.647234	1902	0.775721	1409
15	2.551819	1709	0.704756	1275	45	2.649136	1906	0.777130	1411
20	2.553528	1712	0.706031	1278	50	2.651042	1910	0.778541	1415
25	2.555240	1715	0.707309	1279	55	2.652952	1914	0.779956	1417
30	2.556955	—1719	0.708588	—1282	132 0	2.654866	—1918	0.781373	—1421
35	2.558674	1721	0.709870	1285	5	2.656784	1922	0.782794	1423
40	2.560395	1726	0.711155	1287	10	2.658706	1926	0.784217	1425
45	2.562121	1728	0.712442	1289	15	2.660632	1930	0.785642	1429
50	2.563849	1732	0.713731	1291	20	2.662562	1935	0.787071	1431
55	2.565581	1735	0.715022	1294	25	2.664497	1938	0.788502	1434
128 0	2.567316	—1739	0.716316	—1296	30	2.666435	—1943	0.789936	—1437
5	2.569055	1743	0.717612	1299	35	2.668378	1947	0.791373	1440
10	2.570798	1746	0.718911	1301	40	2.670325	1951	0.792813	1442
15	2.572544	1749	0.720212	1304	45	2.672276	1955	0.794255	1446
20	2.574293	1752	0.721516	1306	50	2.674231	1960	0.795701	1448
25	2.576045	1756	0.722822	1308	55	2.676191	1964	0.797149	1452
30	2 577801	—1760	0.724130	—1311	133 0	2.678155	—1968	0.798601	—1454
35	2.579561	1763	0.725441	1313	5	2.680123	1972	0.800055	1457
40	2.581324	1766	0.726754	1316	10	2.682095	1976	0.801512	1460
45	2.583090	1770	0.728070	1318	15	2.684071	1981	0.802972	1463
50	2.584860	1774	0.729388	1320	20	2.686052	1985	0.804435	1465
55	2.586634	1777	0.730708	1323	25	2.688037	1990	0.805900	1469
129 0	2.588411	—1781	0.732031	—1326	30	2.690027	—1994	0.807369	—1472
5	2.590192	1784	0.733357	1328	35	2.692021	1998	0.808841	1475
10	2.591976	1788	0.734685	1330	40	2.694019	2003	0.810316	1477
15	2.593764	1792	0.736015	1333	45	2.696022	2007	0.811793	1481
20	2.595556	1795	0.737348	1336	50	2.698029	2011	0.813274	1483
25	2.597351	1799	0.738684	1338	55	2.700040	2016	0.814757	1487
30	2.599150	—1802	0.740022	—1341	134 0	2.702056	—2021	0.816244	—1490
35	2.600952	1806	0.741363	1343	5	2.704077	2024	0.817734	1492
40	2.602758	1810	0.742706	1345	10	2.706101	2030	0.819226	1496
45	2.604568	1813	0.744051	1348	15	2.708131	2034	0.820722	1499
50	2.606381	1817	0.745399	1351	20	2.710165	2038	0.822221	1501
55	2.608198	1821	0.746750	1353	25	2 712203	2043	0.823722	1505
130 0	2.610019	—1824	0.748103	—1356	30	2.714246	—2047	0 825227	—1508
5	2.611843	1828	0.749459	1359	35	2.716293	2052	0.826735	1511
10	2.613671	1832	0.750818	1361	40	2.718345	2056	0.828246	1514
15	2.615503	1836	0.752179	1364	45	2.720401	2062	0.829760	1517
20	2.617339	1840	0.753543	1366	50	2.722463	2065	0.831277	1520
25	2.619179	1843	0.754909	1369	55	2.724528	2071	0.832797	1524
30	2.621022		0.756278		135 0	2.726599		0.834321	
		—1847		—1371			—2075		—1526

Angle. °	′	Log. Mean Mot.	Diff.	Log. Dist.	Diff.	Angle. °	′	Log. Mean Mot.	Diff.	Log. Dist.	Diff.
135	5	2.728674	—2075	0.835847	—1526	139	35	2.848199	—2357	0.923268	—1714
	10	2.730754	2080	0.837377	1530		40	2.850561	2362	0.924986	1718
	15	2.732838	2084	0.838910	1533		45	2.852930	2369	0.926708	1722
	20	2.734927	2089	0.840446	1536		50	2.855304	2374	0.928434	1726
	25	2.737021	2094	0.841985	1539		55	2.857684	2380	0.930163	1729
	30	2.739120	2099	0.843527	1542	140	0	2.860070	2386	0.931897	1734
	35	2.741224	—2104	0.845073	—1546		5	2.862462	—2392	0.933634	—1737
	40	2.743332	2108	0.846622	1549		10	2.864860	2398	0.935375	1741
	45	2.745445	2113	0.848174	1552		15	2.867265	2405	0.937121	1746
	50	2.747563	2118	0.849729	1555		20	2.869675	2410	0.938870	1749
	55	2.749686	2123	0.851287	1558		25	2.872091	2416	0.940623	1753
136	0	2.751814	2128	0.852849	1562		30	2.874513	2422	0.942381	1758
	5	2.753946	—2132	0.854414	—1565		35	2.876941	—2428	0.944142	—1761
	10	2.756084	2138	0.855983	1569		40	2.879376	2435	0.945907	1765
	15	2.758226	2142	0.857554	1571		45	2.881816	2440	0.947677	1770
	20	2.760373	2147	0.859129	1575		50	2.884263	2447	0.949450	1773
	25	2.762526	2153	0.860707	1578		55	2.886716	2453	0.951228	1778
	30	2.764683	2157	0.862289	1582	141	0	2.889175	2459	0.953009	1781
	35	2.766845	—2162	0.863874	—1585		5	2.891641	—2466	0.954795	—1786
	40	2.769012	2167	0.865462	1588		10	2.894113	2472	0.956585	1790
	45	2.771185	2173	0.867054	1592		15	2.896591	2478	0.958379	1794
	50	2.773362	2177	0.868649	1595		20	2.899075	2484	0.960178	1799
	55	2.775544	2182	0.870247	1598		25	2.901566	2491	0.961980	1802
137	0	2.777732	2188	0.871849	1602		30	2.904063	2497	0.963787	1807
	5	2.779925	—2193	0.873454	—1605		35	2.906567	—2504	0.965598	—1811
	10	2.782123	2198	0.875063	1609		40	2.909077	2510	0.967413	1815
	15	2.784326	2203	0.876675	1612		45	2.911594	2517	0.969232	1819
	20	2.786534	2208	0.878291	1616		50	2.914117	2523	0.971056	1824
	25	2.788748	2214	0.879910	1619		55	2.916647	2530	0.972884	1828
	30	2.790966	2218	0.881533	1623	142	0	2.919183	2536	0.974716	1832
	35	2.793190	—2224	0.883159	—1626		5	2.921726	—2543	0.976553	—1837
	40	2.795419	2229	0.884788	1629		10	2.924276	2550	0.978394	1841
	45	2.797654	2235	0.886421	1633		15	2.926832	2556	0.980239	1845
	50	2.799894	2240	0.888058	1637		20	2.929394	2562	0.982089	1850
	55	2.802139	2245	0.889698	1640		25	2.931964	2570	0.983943	1854
138	0	2.804389	2250	0.891342	1644		30	2.934540	2576	0.985802	1859
	5	2.806645	—2256	0.892989	—1647		35	2.937124	—2584	0.987665	—1863
	10	2.808907	2262	0.894640	1651		40	2.939714	2590	0.989532	1867
	15	2.811174	2267	0.896294	1654		45	2.942310	2596	0.991404	1872
	20	2.813446	2272	0.897953	1659		50	2.944914	2604	0.993281	1877
	25	2.815723	2277	0.899614	1661		55	2.947525	2611	0.995162	1881
	30	2.818006	2283	0.901280	1666	143	0	2.950142	2617	0.997047	1885
	35	2.820295	—2289	0.902949	—1669		5	2.952767	—2625	0.998937	—1890
	40	2.822589	2294	0.904621	1672		10	2.955398	2631	1.000832	1895
	45	2.824889	2300	0.906298	1677		15	2.958037	2639	1.002731	1899
	50	2.827195	2306	0.907978	1680		20	2.960682	2645	1.004635	1904
	55	2.829506	2311	0.909662	1684		25	2.963335	2653	1.006544	1909
139	0	2.831822	2316	0.911349	1687		30	2.965994	2659	1.008457	1913
	5	2.834145	—2323	0.913041	—1692		35	2.968661	—2667	1.010375	—1918
	10	2.836473	2328	0.914736	1695		40	2.971336	2675	1.012297	1922
	15	2.838806	2333	0.916435	1699		45	2.974017	2681	1.014225	1928
	20	2.841146	2340	0.918137	1702		50	2.976706	2689	1.016157	1932
	25	2.843491	2345	0.919844	1707		55	2.979402	2696	1.018094	1937
	30	2.845842	2351	0.921554	1710	144	0	2.982105	2703	1.020035	1941
			—2357		—1714				—2711		—1947

Angle. °	'	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.	Angle. °	'	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
			—2711		—1947				—3166		—2243
144	5	2.984816	2718	1.021982	1951	148	35	3.143162	3176	1.134894	2249
	10	2.987534	2725	1.023933	1956		40	3.146338	3185	1.137143	2255
	15	2.990259	2733	1.025889	1961		45	3.149523	3195	1.139398	2262
	20	2.992992	2740	1.027850	1966		50	3.152718	3204	1.141660	2268
	25	2.995732	2748	1.029816	1971		55	3.155922	3215	1.143928	2274
	30	2.998480	—2756	1.031787	—1976	149	0	3.159137	—3224	1.146202	—2281
	35	3.001236	2763	1.033763	1980		5	3.162361	3234	1.148483	2288
	40	3.003999	2771	1.035743	1986		10	3.165595	3245	1.150771	2293
	45	3.006770	2778	1.037729	1991		15	3.168840	3254	1.153064	2301
	50	3.009548	2786	1.039720	1996		20	3.172094	3265	1.155365	2307
	55	3.012334	2794	1.041716	2000		25	3.175359	3274	1.157672	2313
145	0	3.015128	—2802	1.043716	—2006		30	3.178633	—3285	1.159985	—2321
	5	3.017930	2809	1.045722	2011		35	3.181918	3296	1.162306	2327
	10	3.020739	2818	1.047733	2016		40	3.185214	3305	1.164633	2333
	15	3.023557	2825	1.049749	2022		45	3.188519	3316	1.166966	2340
	20	3.026382	2833	1.051771	2026		50	3.191835	3327	1.169306	2348
	25	3.029215	2841	1.053797	2032		55	3.195162	3337	1.171654	2354
	30	3.032056	—2850	1.055829	—2037	150	0	3.198499	—3347	1.174008	—2360
	35	3.034906	2857	1.057866	2042		5	3.201846	3358	1.176368	2368
	40	3.037763	2865	1.059908	2047		10	3.205204	3369	1.178736	2375
	45	3.040628	2874	1.061955	2053		15	3.208573	3379	1.181111	2381
	50	3.043502	2882	1.064008	2058		20	3.211952	3390	1.183492	2389
	55	3.046384	2889	1.066066	2063		25	3.215342	3402	1.185881	2396
146	0	3.049273	—2898	1.068129	—2069		30	3.218744	—3412	1.188277	—2402
	5	3.052171	2907	1.070198	2074		35	3.222156	3423	1.190679	2410
	10	3.055078	2915	1.072272	2080		40	3.225579	3434	1.193089	2417
	15	3.057993	2923	1.074352	2085		45	3.229013	3445	1.195506	2424
	20	3.060916	2931	1.076437	2090		50	3.232458	3456	1.197930	2432
	25	3.063847	2940	1.078527	2096		55	3.235914	3468	1.200362	2439
	30	3.066787	—2949	1.080623	—2102	151	0	3.239382	—3479	1.202801	—2446
	35	3.069736	2957	1.082725	2107		5	3.242861	3490	1.205247	2453
	40	3.072693	2965	1.084832	2113		10	3.246351	3502	1.207700	2461
	45	3.075658	2974	1.086945	2118		15	3.249853	3513	1.210161	2469
	50	3.078632	2983	1.089063	2124		20	3.253366	3524	1.212630	2475
	55	3.081615	2992	1.091187	2129		25	3.256890	3537	1.215105	2484
147	0	3.084607	—3000	1.093316	—2136		30	3.260427	—3548	1.217589	—2491
	5	3.087607	3009	1.095452	2141		35	3.263975	3559	1.220080	2498
	10	3.090616	3018	1.097593	2146		40	3.267534	3572	1.222578	2506
	15	3.093634	3027	1.099739	2153		45	3.271106	3583	1.225084	2514
	20	3.096661	3036	1.101892	2158		50	3.274689	3596	1.227598	2522
	25	3.099697	3045	1.104050	2165		55	3.278285	3607	1.230120	2530
	30	3.102742	—3054	1.106215	—2170	152	0	3.281892	—3620	1.232650	—2537
	35	3.105796	3063	1.108385	2176		5	3.285512	3631	1.235187	2545
	40	3.108859	3072	1.110561	2181		10	3.289143	3644	1.237732	2553
	45	3.111931	3081	1.112742	2188		15	3.292787	3656	1.240285	2562
	50	3.115012	3090	1.114930	2194		20	3.296443	3669	1.242847	2569
	55	3.118102	3100	1.117124	2200		25	3.300112	3681	1.245416	2577
148	0	3.121202	—3109	1.119324	—2206		30	3.303793	—3693	1.247993	—2586
	5	3.124311	3118	1.121530	2212		35	3.307486	3706	1.250579	2593
	10	3.127429	3128	1.123742	2218		40	3.311192	3719	1.253172	2602
	15	3.130557	3137	1.125960	2224		45	3.314911	3732	1.255774	2610
	20	3.133694	3146	1.128184	2230		50	3.318643	3744	1.258384	2619
	25	3.136840	3156	1.130414	2237		55	3.322387	3758	1.261003	2626
	30	3.139996	—3166	1.132651	—2243	153	0	3.326145	—3770	1.263629	—2636

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
153	5	3.329915	—3770	1.266265	—2636
	10	3.333698	3783	1.268909	2644
	15	3.337495	3797	1.271561	2652
	20	3.341305	3810	1.274222	2661
	25	3.345128	3823	1.276891	2669
	30	3.348964	3836	1.279569	2678
	35	3.352814	—3850	1.282256	—2687
	40	3.356678	3864	1.284952	2696
	45	3.360555	3877	1.287657	2705
	50	3.364445	3890	1.290370	2713
	55	3.368350	3905	1.293092	2722
154	0	3.372268	3918	1.295824	2732
	5	3.376201	—3933	1.298564	—2740
	10	3.380147	3946	1.301314	2750
	15	3.384108	3961	1.304073	2759
	20	3.388083	3975	1.306841	2768
	25	3.392072	3989	1.309619	2778
	30	3.396076	4004	1.312405	2786
	35	3.400094	—4018	1.315202	—2797
	40	3.404127	4033	1.318007	2805
	45	3.408175	4048	1.320823	2816
	50	3.412237	4062	1.323648	2825
	55	3.416314	4077	1.326482	2834
155	0	3.420406	4092	1.329326	2844
	5	3.424514	—4108	1.332181	—2855
	10	3.428636	4122	1.335045	2864
	15	3.432774	4138	1.337919	2874
	20	3.436927	4153	1.340802	2883
	25	3.441096	4169	1.343696	2894
	30	3.445280	4184	1.346601	2905
	35	3.449480	—4200	1.349515	—2914
	40	3.453696	4216	1.352440	2925
	45	3.457928	4232	1.355375	2935
	50	3.462175	4247	1.358320	2945
	55	3.466439	4264	1.361276	2956
156	0	3.470719	4280	1.364242	2966
	5	3.475016	—4297	1.367219	—2977
	10	3.479329	4313	1.370207	2988
	15	3.483658	4329	1.373205	2998
	20	3.488004	4346	1.376215	3010
	25	3.492367	4363	1.379235	3020
	30	3.496747	4380	1.382266	3031
	35	3.501144	—4397	1.385309	—3043
	40	3.505558	4414	1.388362	3053
	45	3.509989	4431	1.391427	3065
	50	3.514438	4449	1.394503	3076
	55	3.518904	4466	1.397590	3087
157	0	3.523388	4484	1.400689	3099
	5	3.527889	—4501	1.403800	—3111
	10	3.532408	4519	1.406922	3122
	15	3.536946	4538	1.410056	3134
	20	3.541501	4555	1.413201	3145
	25	3.546075	4574	1.416359	3158
	30	3.550668	4593	1.419529	3170
			—4611		—3181

Angle. °	′	Log. Mean Mot.	Diff.	Log. Diſt.	Diff.
157	35	3.555279	—4611	1.422710	—3181
	40	3.559908	4629	1.425904	3194
	45	3.564556	4648	1.429110	3206
	50	3.569223	4667	1.432328	3218
	55	3.573910	4687	1.435559	3231
158	0	3.578615	4705	1.438802	3243
	5	3.583340	—4725	1.442058	—3256
	10	3.588085	4745	1.445327	3269
	15	3.592849	4764	1.448608	3281
	20	3.597633	4784	1.451903	3295
	25	3.602437	4804	1.455210	3307
	30	3.607260	4823	1.458530	3320
	35	3.612105	—4845	1.461864	—3334
	40	3.616969	4864	1.465211	3347
	45	3.621855	4886	1.468571	3360
	50	3.626760	4905	1.471945	3374
	55	3.631687	4927	1.475333	3388
159	0	3.636635	4948	1.478734	3401
	5	3.641604	—4969	1.482149	—3415
	10	3.646595	4991	1.485578	3429
	15	3.651607	5012	1.489021	3443
	20	3.656640	5033	1.492478	3457
	25	3.661696	5056	1.495950	3472
	30	3.666774	5078	1.499436	3486
	35	3.671873	—5099	1.502936	—3500
	40	3.676995	5122	1.506451	3515
	45	3.682140	5145	1.509981	3530
	50	3.687308	5168	1.513525	3544
	55	3.692499	5191	1.517085	3560
160	0	3.697713	5214	1.520660	3575
	5	3.702950	—5237	1.524249	—3589
	10	3.708210	5260	1.527855	3606
	15	3.713495	5285	1.531476	3621
	20	3.718803	5308	1.535112	3636
	25	3.724135	5332	1.538764	3652
	30	3.729492	5357	1.542432	3668
	35	3.734873	—5381	1.546116	—3684
	40	3.740279	5406	1.549816	3700
	45	3.745710	5431	1.553533	3717
	50	3.751166	5456	1.557266	3733
	55	3.756647	5481	1.561015	3749
161	0	3.762154	5507	1.564782	3767
	5	3.767687	—5533	1.568565	—3783
	10	3.773246	5559	1.572365	3800
	15	3.778831	5585	1.576182	3817
	20	3.784442	5611	1.580017	3835
	25	3.790080	5638	1.583869	3852
	30	3.795745	5665	1.587738	3869
	35	3.801437	—5692	1.591626	—3888
	40	3.807157	5720	1.595531	3905
	45	3.812904	5747	1.599454	3923
	50	3.818679	5775	1.603396	3942
	55	3.824483	5804	1.607356	3960
162	0	3.830315	5832	1.611335	3979
			—5860		—3998

Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Diff.	Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Diff.
° ′		—5860		—3998	° ′		—7924		—5353
162 5	3.836175	5890	1.615333	4016	166 35	4 204152	7976	1.865001	5388
10	3.842065	5918	1.619349	4036	40	4.212128	8027	1.870389	5421
15	3.847983	5948	1.623385	4055	45	4.220155	8080	1 875810	5456
20	3.853931	5978	1.627440	4074	50	4.228235	8132	1.881266	5490
25	3.859909	6008	1.631514	4094	55	4.236367	8186	1.886756	5526
30	3.865917	—6038	1.635608	—4114	167 0	4.244553	—8241	1.892282	—5562
35	3.871955	6069	1.639722	4134	5	4.252794	8296	1.897844	5599
40	3.878024	6100	1.643856	4154	10	4.261090	8352	1.903443	5635
45	3.884124	6131	1.648010	4175	15	4.269442	8408	1.909078	5672
50	3.890255	6162	1.652185	4195	20	4 277850	8465	1.914750	5710
55	3.896417	6194	1.656380	4216	25	4.286315	8523	1.920460	5748
163 0	3.902611	—6226	1.660596	—4237	30	4.294838	—8582	1.926208	—5788
5	3.908837	6258	1.664833	4258	35	4.303420	8642	1.931996	5826
10	3.915095	6291	1.669091	4280	40	4.312062	8701	1.937822	5866
15	3.921386	6324	1.673371	4301	45	4.320763	8763	1.943688	5907
20	3.927710	6358	1.677672	4324	50	4.329526	8825	1.949595	5947
25	3.934068	6392	1.681996	4345	55	4.338351	8888	1.955542	5989
30	3.940460	—6425	1.686341	—4368	168 0	4.347239	—8951	1.961531	—6031
35	3.946885	6459	1.690709	4390	5	4.356190	9016	1.967562	6073
40	3.953344	6494	1.695099	4413	10	4.365206	9082	1.973635	6117
45	3.959838	6530	1.699512	4436	15	4.374288	9147	1.979752	6161
50	3.966368	6565	1.703948	4459	20	4.383435	9215	1.985913	6205
55	3.972933	6600	1.708407	4482	25	4.392650	9284	1.992118	6250
164 0	3 979533	—6637	1.712889	—4507	30	4.401934	—9352	1.998368	—6296
5	3.986170	6673	1.717396	4530	35	4.411286	9423	2.004664	6342
10	3.992843	6710	1.721926	4555	40	4.420709	9494	2.011006	6390
15	3.999553	6747	1.726481	4579	45	4.430203	9567	2.017396	6437
20	4.006300	6785	1.731060	4603	50	4.439770	9640	2.023833	6486
25	4.013085	6823	1.735663	4629	55	4.449410	9714	2.030319	6535
3	4.019908	—6861	1.740292	—4654	169 0	4.459124	—9790	2.036854	—6585
35	4.026769	6900	1.744946	4680	5	4.468914	9867	2.043439	6636
40	4.033669	6940	1.749626	4705	10	4.478781	9945	2.050075	6688
45	4.040609	6979	1.754331	4731	15	4.488726	10024	2.056763	6740
50	4.047588	7019	1.759062	4758	20	4.498750	10104	2.063503	6792
55	4.054607	7060	1.763820	4785	25	4.508854	10186	2.070295	6847
165 0	4.061667	—7101	1.768605	—4811	30	4.519040	10269	2.077142	—6902
5	4.068768	7142	1.773416	4839	35	4.529309	10353	2.084044	6956
10	4.075910	7185	1.778255	4866	40	4.539662	10438	2.091002	7014
15	4.083095	7227	1.783121	4894	45	4.550100	10526	2.098016	7072
20	4.090322	7269	1.788015	4923	50	4.560626	10614	2.105088	7130
25	4.097591	7313	1.792938	4950	55	4.571240	10704	2.112218	7190
30	4.104904	—7357	1.797888	—4980	170 0	4.581944	10796	2.119408	—7250
35	4.112261	7401	1.802868	5009	5	4.592740	10888	2.126658	7312
40	4.119662	7446	1.807877	5038	10	4.603628	10982	2.133970	7374
45	4.127108	7491	1.812915	5069	15	4.614610	11079	2.141344	7438
50	4.134599	7537	1 817984	5098	20	4.625689	11176	2.148782	7503
55	4.142136	7584	1.823082	5129	25	4.636865	11276	2.156285	7568
166 0	4.149720	—7630	1.828211	—5160	30	4.648141	11377	2.163853	—7636
5	4.157350	7678	1.833371	5191	35	4.659518	11480	2.171489	7703
10	4.165028	7727	1.838562	5223	40	4.670998	11585	2.179192	7773
15	4.172755	7775	1.843785	5255	45	4.682583	11691	2.186965	7844
20	4.180530	7824	1.849040	5288	50	4.694274	11799	2.194809	7916
25	4.188354	7874	1.854328	5320	55	4.706073	11910	2.202725	7988
30	4.196228	—7924	1.859648	—5353	171 0	4.717983	12023	2.210713	—8064

A general Table of the Parabola.

Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Dist.	Angle.	Log. Mean Mot.	Diff.	Log. Dist.	Dist.
° ′		12023		—8064	° ′		24304		16227
171 5	4.730006	12138	2.218777	8139	175 35	5.641401	24770	2.828331	16537
10	4.742144	12254	2.226916	8217	40	5.666171	25253	2.844868	16859
15	4.754398	12373	2.235133	8296	45	5.691424	25754	2.861727	17192
20	4.766771	12495	2.243429	8377	50	5.717178	26276	2.878919	17540
25	4.779266	12618	2.251806	8458	55	5.743454	26820	2.896459	17903
30	4.791884	12745	2.260264	—8542	176 0	5.770274	27387	2.914362	18279
35	4.804629	12873	2.268806	8627	5	5.797661	27978	2.932641	18673
40	4.817502	13004	2.277433	8715	10	5.825639	28594	2.951314	19084
45	4.830506	13139	2.286148	8803	15	5.854233	29239	2.970398	19513
50	4.843645	13274	2.294951	8894	20	5.883472	29912	2.989911	19961
55	4.856919	13414	2.303845	8986	25	5.913384	30619	3.009872	20432
172 0	4.870333	13557	2.312831	—9081	30	5.944003	31358	3.030304	20925
5	4.883890	13701	2.321912	9177	35	5.975361	32135	3.051229	21441
10	4.897591	13850	2.331089	9275	40	6.007496	32950	3.072670	21985
15	4.911441	14002	2.340364	9376	45	6.040446	33808	3.094655	22556
20	4.925443	14156	2.349740	9479	50	6.074254	34711	3.117211	23158
25	4.939599	14314	2.359219	9584	55	6.108965	35664	3.140369	23793
30	4.953913	14476	2.368803	—9691	177 0	6.144629	36670	3.164162	24463
35	4.968389	14642	2.378494	9801	5	6.181299	37736	3.188625	25173
40	4.983031	14811	2.388295	9914	10	6.219035	38865	3.213798	25925
45	4.997842	14984	2.398209	10028	15	6.257900	40062	3.239723	26723
50	5.012826	15160	2.408237	10146	20	6.297962	41336	3.266446	27572
55	5.027986	15342	2.418383	10266	25	6.339298	42693	3.294018	28476
173 0	5.043328	15528	2.428649	10390	30	6.381991	44143	3.322494	29442
5	5.058856	15718	2.439039	10516	35	6.426134	45694	3.351936	30476
10	5.074574	15912	2.449555	10645	40	6.471828	47357	3.382412	31584
15	5.090486	16112	2.460200	10778	45	6.519185	49147	3.413996	32777
20	5.106598	16316	2.470978	10913	50	6.568332	51077	3.446773	34063
25	5.122914	16526	2.481891	11053	55	6.619409	53164	3.480836	35453
30	5.139440	16741	2.492944	11196	178 0	6.672573	55428	3.516289	36964
35	5.156181	16962	2.504140	11343	5	6.728001	57895	3.553253	38607
40	5.173143	17188	2.515483	11493	10	6.785896	60590	3.591860	40403
45	5.190331	17421	2.526976	11648	15	6.846486	63549	3.632263	42375
50	5.207752	17660	2.538624	11806	20	6.910035	66812	3.674638	44550
55	5.225412	17905	2.550430	11970	25	6.976847	70426	3.719188	46960
174 0	5.243317	18157	2.562400	12137	30	7.047273	74454	3.766148	49644
5	5.261474	18416	2.574537	12310	35	7.121727	78972	3.815792	52655
10	5.279890	18684	2.586847	12487	40	7.200699	84072	3.868447	56055
15	5.298574	18958	2.599334	12670	45	7.284771	89876	3.924502	59925
20	5.317532	19240	2.612004	12858	50	7.374647	96542	3.984427	64367
25	5.336772	19532	2.624862	13051	55	7.471189	104275	4.048794	69522
30	5.356304	19832	2.637913	13252	179 0	7.575464	113355	4.118316	75576
35	5.376136	20142	2.651165	13456	5	7.688819	124168	4.193892	82783
40	5.396278	20460	2.664621	13669	10	7.812987	137264	4.276675	91514
45	5.416738	20789	2.678290	13889	15	7.950251	153452	4.368189	102305
50	5.437527	21130	2.692179	14114	20	8.103703	173967	4.470494	115981
55	5.458657	21480	2.706293	14348	25	8.277670	200834	4.586475	133893
175 0	5.480137	21843	2.720641	14589	30	8.478504	237539	4.720368	158362
5	5.501980	22219	2.735230	14839	35	8.716043	290726	4.878730	193819
10	5.524199	22607	2.750069	15098	40	9.006769	374813	5.072549	249877
15	5.546806	23009	2.765167	15365	45	9.381582	528271	5.322426	352182
20	5.569815	23425	2.780532	15642	50	9.909853	903089	5.674608	602060
25	5.593240	23857	2.796174	15930	55	10.812942		6.276668	
30	5.617097	24304	2.812104	16227	180 0				

TABLE III. *Errors in taking Proportional Parts of the above Parabolick Table.*

Ang. from Per.	Log.M.M.	Ang. by Pro. Par.	Log. of Diſtance True.	Log. of Diſtance From M.M.	Log. of Diſtance Equal Div.	Error.	Diſt. too great.
45° 2′ 30″	1.516934	45° 2′ 30″	0.068900	900	900	.000000	
154 57 30	3.418358	154 57 29.9	1.327903	903	904	.000001	
159 57 30	3.695102	159 57 29.8	1.518870	870	872	.000002	
169 57 30	4.576581	169 57 29.7	2.115806	806	813	.000007	1.00002
173 57 30	5.234333	173 57 29.5	2.556394	394	415	.000021	1.00005
174 57 30	5.469352	174 57 29.4	2.713437	437	467	.000030	1.00007
178 57 30	7.522283	178 57 27.0	4.082860	859	3555	.000695	1.00108
179 52 30	10.284669	179 52 4.5	5.924485	486	75638	.051153	1.12500

TABLE IV. *Equation of the Sun's Place, from the Menſtrual Parallax.*

Add.		☉'s Per. ☽'s Per.	☉'s Per. ☽'s Ap.	☉'s Ap. ☽'s Per.	☉'s Ap. ☽'s Ap	Subſtract.	
s °	s °	″	″	″	″	s °	s °
0 0	6 0	0	0	0	0	6 0	12 0
5	25					5	25
10	20	3	3	2	3	10	20
15	15					15	15
20	10	5	6	5	6	20	10
25	5					25	5
1 0	5 0	8	9	7	8	7 0	11 0
5	25					5	25
10	20	10	12	10	11	10	20
15	15					15	15
20	10	12	14	11	13	20	10
25	5					25	5
2 0	4 0	13	15	13	14	8 0	10 0
5	25					5	25
10	20	14	16	14	15	10	20
15	15					15	15
20	10	15	17	14	16	20	10
25	5					25	5
3 0	3 0	15	17	15	17	9 0	9 0

TABLE V. *Increaſe or Decreaſe of the Earth's Diſt. from the Sun, from the Menſtrual Parallax.*

Add.		☽'s Par. 54′	55′	56′	57′	58′	59′	60′	61′	Subſtract.	
s °	s °									s °	s °
0 0	12 0	0.0000795	780	766	753	740	727	715	703	6 0	6 0
5	25	0.0000791	777	763	750	737	724	712	701	5	25
10	20	0.0000783	768	755	741	729	716	704	693	10	20
15	15	0.0000767	753	740	727	714	702	691	679	15	15
20	10	0.0000747	733	720	707	695	683	672	661	20	10
25	5	0.0000720	707	694	682	671	659	648	638	25	5
1 0	11 0	0.0000688	675	663	652	641	630	619	609	7 0	5 0
5	25	0.0000651	639	628	617	606	596	586	576	5	25
10	20	0.0000609	598	587	577	567	557	548	539	10	20
15	15	0.0000562	552	542	532	523	514	506	497	15	15
20	10	0.0000511	501	492	484	476	467	460	452	20	10
25	5	0.0000456	447	439	432	424	417	410	403	25	5
2 0	10 0	0.0000397	390	383	376	370	364	358	352	8 0	4 0
5	25	0.0000336	330	324	318	313	307	302	297	5	25
10	20	0.0000272	267	262	257	253	249	245	241	10	20
15	15	0.0000206	202	198	195	191	188	185	182	15	15
20	10	0.0000138	135	133	131	128	126	124	122	20	10
25	5	0.0000069	068	067	066	064	063	062	061	25	5
3 0	9 0	0.0000000	000	000	000	000	000	000	000	9 0	3 0

Tables IV. and V. are to be thus uſed: From the moon's place ſubſtract the ſun's, and againſt the remainder in table IV. is the angle CSE (fig. 6.) to be added to, or ſubſtracted from the ſun's place as found by the common tables. Againſt the remainder in table V. is given the length of the line ED in parts of the earth's mean diſtance, to be added to, or ſubſtracted from the diſtance of the earth from the ſun, which the tables of the ſun give.

TAB. VI. *Decimals of a Degree reduced to Minutes and Seconds.*

	″		′	″		′	″
.001	3.6	.01	0	36	.1	6	0
.002	7.2	.02	1	12	.2	12	0
.003	10.8	.03	1	48	3	18	0
.004	14.4	.04	2	24	.4	24	0
.005	18.0	.05	3	0	.5	30	0
.006	21.6	.06	3	36	.6	36	0
.007	25.2	.07	4	12	.7	42	0
.008	28.8	.08	4	48	.8	48	0
[illegible]	[illegible]4	.09	5	24	.9	54	0

TABLE VII. *Decimals of a Day reduced to Hours, Minutes, and Seconds.*

	″		′	″		′	″		h	′	″		h	′	″
00001	0.864	.0001	0	8.64	.001	1	26.4	.01	0	14	24	.1	2	24	0
.00002	1.728	.0002	0	17.28	.002	2	52.8	.02	0	28	48	.2	4	48	0
.00003	2.592	.0003	0	25.92	.003	4	19.2	.03	0	43	12	.3	7	12	0
.00004	3.456	.0004	0	34.56	.004	5	45.6	.04	0	57	36	.4	9	36	0
.00005	4.320	.0005	0	43.20	.005	7	12.0	.05	1	12	0	.5	12	0	0
.00006	5.184	.0006	0	51.84	.006	8	38.4	.06	1	26	24	.6	14	24	0
.00007	6.048	.0007	1	0.48	.007	10	4.8	.07	1	40	48	.7	18	48	0
.00008	6.912	.0008	1	9.12	.008	11	31.2	.08	1	55	12	.8	19	12	0
.00009	7.776	.0009	1	17.76	.009	12	57.6	.09	2	9	36	.9	21	36	0

TABLE VIII.

	Comet 1680.					Comet 1682.			
Days Mot.	Ang.fromPer. °	′	″	Dist.fr.☉	Ordinate.	Ang.fromPer. °	′	″	Dist.fr.☉
¼	132	58	6	0.03847	0 02815				
½	143	53	13	0.06375	0.03757				
1	151	56	38	0.10425	0.04903				
2	158	1	52	0.16874	0.06312				
3	160	54	58	0.22289	0.07287				
4	162	42	52	0.27124	0.08059	12	26	46	0.59022
8	166	21	18	0.43402	0.10239	24	16	54	0.61027
12	168	6	23	0.57059	0.11760	35	10	54	0.64192
16	169	12	25	0.69249	0.12968	44	54	55	0 68294
20		59	19	0.80453	0.13986	53	27	18	0.73117
24	170	35	4	0.90929	0.14875	60	53	1	0.78470
28	171	3	36	1.00836	0.15670	67	20	5	0.84204
32		27	7	1.10281	0.16392	72	56	25	0.90196
36		47	0	1.19339	0.17055	77	50	28	0.96361
40	172	4	8	1.28067	0.17671	82	8	50	1.02634
44		19	6	1.36508	0.18247	85	57	18	1.08969
48		32	21	1.44697	0.18789	89	20	35	1.15334
52		44	12	1.52661	0.19301	92	22	36	1.21703
56		55	7	1.60424	0.19777	95	6	32	1.28059
60	173	4	36	1.68003	0.20251	97	34	58	1.34390
64		13	28	1.75416	0.20696	99	50	6	1.40686
68		21	39	1.82676	0.21120	101	53	41	1.46943
72		29	12	1.89796	0.21529	103	47	13	1.53154
76		36	13	1.96783	0.21923	105	31	54	1.59316
80		42	44	2.03651	0.22304	107	8	50	1.65430
84		48	51	2.10403	0.22672	108	38	53	1.71491
88		54	35	2.17050	0.23028	110	2	49	1.77501
92		59	59	2.23597	0.23373	111	21	16	1.83461
96	174	5	4	2.30049	0.23709	112	34	48	1.89368
100		9	53	2.36413	0.24036	113	43	54	1.95225
104		14	27	2.42692	0.24354	114	49	0	2.01032
108		18	46	2.48892	0.24665	115	50	27	2.06791
112		22	54	2.55005	0.24965	116	48	35	2.12501
116		26	50	2.61065	0.25261	117	43	42	2.18163
120		30	35	2.67046	0.25550	118	36	2	2.23779

TABLE IX. *Abſciſſa and Ordinate of a Parabola at different Angles from the Vertex.*

Angle	Abſciſſa.	Ordinate.	Angle	Abſciſſa.	Ordinate.
10°	0.00765	0.17498	130°	4.59891	4.28901
20	0.03109	0.35265	140	7.54863	5.49495
30	0.07180	0.53590	150	13.92821	7.46410
40	0.13247	0.72794	160	32.16343	11.34254
50	0.21744	0.93261	170	130.64610	22.86011
60	0.33333	1.15470	175	524.58248	45.80752
70	0.49029	1.40042	176	820.03500	57.27250
80	0.70409	1.67820	177	1458.35842	76.37693
90	1.00000	2.00000	178	3282.13970	114.57992
100	1.42028	2.38351	179	13130.55876	229.17730
110	2.03961	2.85630	179½	52524.23496	458.36332
120	3.00000	3.46410	179¾	210098.93985	916.73103

TABLE X.

Hourly Motion of Comets.

Perih. Diſt.	Parts of M. O.	Miles.
Comet 1680	.012952	997000
0.1	.003205	247000
0.2	.002267	175000
0.3	.001851	143000
0.4	.001603	123000
0.5	.001434	110000
0.6	.001309	101000
0.7	.001212	93000
0.8	.001133	87000
0.9	.001068	82000
1.0	.001014	78000
1.5	.000828	64000
2.0	.000717	55000
2.5	.000641	49000
3.0	.000585	45000
3.5	.000542	42000
4.0	.000507	39000

Time from Perih. to Lat. rect.

	Dec. of Days.	d	h	′	″
Comet 1680	0.052545	0	1	15	40
0.1	3.46635	3	11	11	32
0.2	9.80430	9	19	18	12
0.3	18.01165	18	0	16	46
0.4	27.73076	27	17	32	16
0.5	38.75490	38	18	7	4
0.6	50.94464	50	22	40	17
0.7	64.19757	64	4	44	30
0.8	78.43440	78	10	25	33
0.9	93.59129	93	14	11	27
1.0	109.61543	109	14	46	13
1.5	201.3764	201	9	2	
2.0	310.0392	310	0	56	
2.5	433.2929	433	7	2	
3.0	569.5785	569	13	53	
3.5	717.7507	717	18	1	
4.0	876.9232	876	22	9	

TABLE XI.

Apparent Motion of the Comet of 1682, at its next Return, whatever Month of the Year its Perihelion happens in.

Perihelion April 20.

Time.	Long.	Lat.	Curt. Diſt.
	°	°	
Apr. 20	♈ 1.8	N. 8.2	1.18
30	3.3	9.1	0.80
May 10	11.9	9.8	0.41
20	♋ 2.2	1.5	0.17
30	♌ 26.5	S. 7.1	0.48
June 9	♍ 6.7	8.1	0.85

Perihelion May 21.

Time.	Long.	Lat.	Curt. Diſt.
May 11	♈ 23.2	N. 8.5	1.29
21	26.2	10.8	0.90
31	♉ 12.3	14.4	0.50
June 10	♋ 15.1	12.1	0.32
20	♌ 28.3	0.4	0.60
30	♍ 10.8	S. 3.5	0.97

Perihelion June 21.

Time.	Long.	Lat.	Curt. Diſt.
June 11	♉ 15.9	N. 10.7	1.01
21	♊ 1.2	15.3	0.62
July 1	♋ 20.4	17.0	0.42
11	♍ 4.7	6.0	0.65
21	19.1	0.2	1.02

Perihelion July 23.

Time.	Long.	Lat.	Curt. Diſt.
July 3	♊ 2.6	N. 9.7	1.10
13	16.0	15.1	0.80
23	♋ 27.7	20.4	0.45
Aug. 2	♍ 15.9	11.1	0.56
12	♎ 1.5	3.9	1.03

Perihelion Auguſt 22.

Time.	Long.	Lat.	Curt. Diſt.
July 23	♊ 12.9	N. 8.8	1.13
Aug. 2	26.3	13.9	0.75
12	♌ 0.7	22.8	0.45
22	♍ 26.0	16.5	0.58
Sept. 1	♎ 15.1	7.8	0.95

Perihelion September 23.

Time.	Long.	Lat.	Curt. Diſt.
Aug. 14	♊ 23.9	N. 7.4	1.09
24	♋ 4.5	13.2	0.71
Sept. 3	♌ 8.3	25.4	0.39
13	♎ 12.3	22.0	0.47
23	♏ 4.1	11.4	0.85

Perihelion October 23.

Time.	Long.	Lat.	Curt. Diſt.
	°	°	
Sept. 3	♊ 29.2	N. 6.3	1.01
13	♋ 7.6	13.0	0.62
23	♌ 9.3	31.0	0.28
Oct. 3	♏ 6.0	28.7	0.34
13	26.8	14.6	0.73
23	♐ 0.2	8.7	1.12

Perihelion November 22.

Time.	Long.	Lat.	Curt. Diſt.
Sept. 13	♊ 27.7	N. 2.6	1.25
23	29.8	5.2	0.88
Oct. 3	♋ 1.9	12.6	0.50
13	12.	51.	0.11
15	♌ 7.	74.	0.04
16	♎ 16.	78.	0.03
23	♐ 23.	31.	0.28
Nov. 2	25.6	15.8	0.66
12	24.5	10.2	1.03

Perihelion December 21.

Time.	Long.	Lat.	Curt. Diſt.
Oct. 2	♊ 26.7	N. 0.7	1.12
12	23.0	3.5	0.77
22	11.1	10.7	0.42
Nov. 1	♈ 16.6	28.3	0.21
11	♒ 12.2	20.2	0.39
21	♑ 26.5	13.4	0.70
Dec. 1	20.8	10.5	1.01
Feb. 19	♐ 16.4	S. 9.2	1.13
Mar. 1	3.8	13.8	0.98
11	♏ 19.0	19.1	0.88
21	0.2	23.0	0.83
31	♎ 12.4	23.8	0.91

Perihelion January 20.

Time.	Long.	Lat.	Curt. Diſt.
Oct. 12	♊ 24.3	S. 2.3	1.31
22	18.7	1.1	0.99
Nov. 1	6.8	N. 1.2	0.71
11	♉ 6.4	5.2	0.51
21	♈ 4.2	9.2	0.50
Dec. 1	♓ 8.8	9.5	0.66
11	♒ 25.0	9.2	0.89
21	16.9	8.5	1.11
Mar. 1	♑ 9.5	S. 3.4	1.02
11	0.2	8.7	0.80
21	♐ 12.9	16.4	0.62
31	♏ 13.3	24.2	0.54
Apr. 10	♎ 13.0	25.6	0.63
20	♍ 24.9	22.5	0.85
30	16.7	19.5	1.13

Perihelion February 19.

Time.	Long.	Lat.	Curt. Diſt.
Nov. 1	♊ 15.7	S. 4.1	1.21
11	4.6	3.1	0.98
21	♉ 18.6	1.3	0.83
Dec. 1	♈ 26.9	N. 1.0	0.78
11	8.0	3.2	0.86
21	♓ 24.8	4.6	1.00
Mar. 11	♒ 10.9	3.6	1.10
21	4.8	0.4	0.83
31	♑ 24.0	S. 6.3	0.54
Apr. 10	♐ 22.2	22.2	0.30
20	♎ 17.1	29.2	0.33
30	♍ 21.3	21.7	0.61
May 10	12.9	17.8	0.93

Perihelion March 20.

Time.	Long.	Lat.	Curt. Diſt.
Nov. 30	♉ 21.2	S. 3.3	1.13
Dec. 10	7.2	2.7	1.09
20	♈ 24.3	1.0	1.14
Mar. 30	♓ 6.5	N. 7.0	1.18
Apr. 9	3.9	4.7	0.76
19	♒ 29.0	0.8	0.40
29	♑ 22.	S. 50.	0.05
30	♐ 11.	62.	0.04
May 9	♒ 10.8	20.1	0.33
19	8.6	14.8	0.70
29	9.0	13.8	1.07

TABLE XII.

Place where the Comet of 1682 may be firſt expected to appear any Month.

		Longitude.		Latitude.	Diſt. from Perihelion.	Bearing and Time.
January		Scarce to be ſeen.				
February	End	Retrog. between	30° and 15° of ♐	Small increaſing S.	7 weeks after its perih.	Low S. E. morning.
March	Beginning	——— ———	30 and 15 of ♑	Small N. or S.	A month after perih.	
	End	——— ———	30 and 0 of ♒	Small N. decreaſing		
April	Beginning	——— ———	15 and 0 of ♓	Small N. decreaſing	2 or 3 weeks after.	Low E. morning.
	End	Stationary	10 ♈ and 20 ♓	Small N.		
May	Beginning	———	Middle of ♈	N.	About the perihelion.	
	End	Direct	Beginning of ♉		1, 2, or 3 weeks before.	
June	Beginning	———	Beginning of ♉	N. increaſing		E. morning.
	End	———	End of ♉			N. E. morning.
July	Beginning	———	Beginning of ♊		2, 3, 4, or 5 weeks.	Low N. E. morning.
	End	———	Middle of ♊			
Auguſt		———	End of ♊		5, 6, 7, or 8 weeks.	Riſes N. E. midnight.
September		Stationary	25 and 30 of ♊	Small increaſing N.	2 months before.	—— N. E. at 11.
October		Retrograde	End of ♊	Small S. or N.	2 or 3 months.	—— N. E. at 9
November,	Beginning	———	Beginning of ♊	Small S.	3 months before per.	—— N. E. at 7.
	Middle	———	5 ♊ and 20 ♉	Small S.		—— E. at 5.
	End	———	Beginning of ♉	Small S. or N.		Low E. evening.
December,	Beginning	———	Begin. of ♉, End of ♈	Small S. or N.	11, 12, 13, or 14 weeks.	E. evening.
	End	———	Beginning of ♈	Very faint.		S. E. evening.

ERRATA.

			for	read				for	read
Page 1	Line 7	— —	them ſelves	themſelves	Tab. 1	1718	Col. 7	6° 28′ 50″	6° 28′ 44″
2	12	— —	aſtronomically	in ſome meaſure aſtronomically	2	64° 15′	2	1.726681	1.726581
10	N°. 22	Col. 2	B D D	B D D′	7	Line 7	10	18^h 48′	16^h 48′
24	Line 43	— —	I nor can	nor can I	10	0.4		27^d 17^h 32′ 16″	27^d 17^h 32′ 18″
					11	Perih. Mar. 20 Line 9		♒ $\overset{\circ}{10.8}$	♍ $\overset{\circ}{10.8}$

THE INDEX.

Page
Appian firſt obſerved comets, 2
Ariſtotle's opinion, 1
Calculation of orbits, conſtruct firſt, 7
why altered from Sir I. Newton, 11
Calculators of orbits, which beſt, 13
Comets do not go to other ſyſtems, 4
have no ſenſible parallax, 2, 3
how far ſeen from perihelion, 15
nature and uſes unknown, 24
of 1682, *where to look for,* 23
places to calculate, 18
to conſtruct, 23
revolving bodies, 2, 5
true motion found out, 4
Correction how to gueſs at, 12
Sir I. Newton's laſt why omitted, 12
Demonſtration of parabolick table, 15
Diurnal motion to find, 18
Ellipſis, a comet's orbit ſo, 5
Errors in parabolick table, what, 17
Examples of calculating a comet's place, — — — 20
Fall of a comet to find, 7, 11
Figures to be drawn before calculating, 9
Gravity, Dr. Hooke's thoughts of it, 2
keeps comets in their orbits, 4
Gueſſes how to correct, 12
Halley's table of parabola, defects in, 15
Hevelius's opinion of comets, 3
how far true, 4
Hooke's thoughts of gravity, 2
Irregularity of comet's motion, 5, 24
Newton firſt proved a comet's motion, 3
Node aſcending muſt be inſerted, 13, 14

Page
Orbits of comets to calculate, 9
to conſtruct, 7
to draw, 22
truth of Betts's proved, 13, 14
whence collected, 14
Parabola, a comet's orbit nearly ſo, 3, 4
how to draw, 20, 21
to reduce to an ellipſis, 12
Parabolick table how calculated, 16
uſes of it, 20, 21
Parallax menſtrual, 9
Perihelion from node why altered, 18
Periods of comets, 5
to find, 23
why unequal, 5
Petit's opinion of comets, 2
Place of comet to calculate, 18
Projectiles, motion of, 22
Projection of the orbit, a parabola, 22
Proportional parts to find, 18
Seneca's opinion of comets, 2
Sines and tangents to change, 19
Studies may be of uſe, though not known, — — — 4
Table of elements, articles in, 14
parabola, to calculate, 16
ſuited to Dr. Halley's, 16
uſes of it, 20, 21
ſeveral explained, 22, 23, 24
Times of obſervation to chuſe, 7
Velocity of a comet, 4, 17
Works of God numberleſs, 24
ſhould lead us to God, 25
wiſdom ſhewn in them, 26

THE END.

Corrections and Improvements in BARKER's *Diſcoveries concerning Comets*; found out ſince it was publiſhed.

P. 10, N° 15 $BEb = HAC$
31 $BE'b' = H'A'C'$
32 $SE'I' = \text{ſuppl.}H'A'C' + \text{ſuppl.}SE'B$
41 for $\chi\psi\omega$, read $\chi\psi\omega \times \sqrt{2}$.
82 $HC' - Hc' \mp cp = Cp$.
83 for $C'g$ read $C'G$
51 Tab. VIII. 4. for 12° 26′ 46″ read 12° 25′ 5″.
for 0.59022 read 0.59018.

If in Page 9 and 10, N° 5, 6, and 37, are not correct enough, (as in a very oblique Comet perhaps they may not) SL N° 6, and SR N° 37, may be found more correctly thus:

Take SB, $S\mu$ and $B\gamma$ as found by a former conſtruction or calculation; and omitting N° 5 and 6, ſay,

Former SB : former $S\mu$ :: preſent SB : preſent $S\mu$

Former $B\gamma$: preſent $B\gamma$ :: former $\mu\nu$: preſent $\mu\nu$. ν is the point in the orbit perpendicularly over μ, and found as below.

Then $S\mu : \mu\nu :: R : \text{tang.}\ \mu S\nu$

$\text{coſ.}\ \mu S\nu : R :: S\mu + \frac{1}{3} I\mu : SL$

To find $\mu\nu$, omit N° 37, and having by N° 39 found $KM = AC$, and $KN = CN - AM$.

In the triangle $SB\mu'$, from SB, $BS\mu'$ ($= IS\mu' - I'SE' - BSE'$) and $S\mu'B$ ($= S\mu'I' + I'\lambda'i'$) find $B\mu'$.

$KM : KN :: B\mu' : x \qquad \because B\gamma - x = \mu\nu$.

Then $S\mu' : \mu\nu :: R : \text{tang}\ \mu S\nu$.

$\text{coſ.}\ \mu S\nu : R :: S\rho : SR$.